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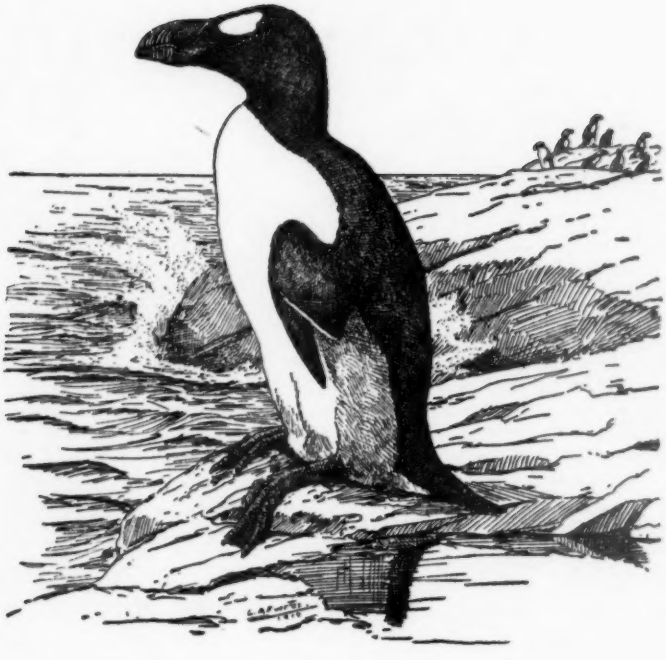

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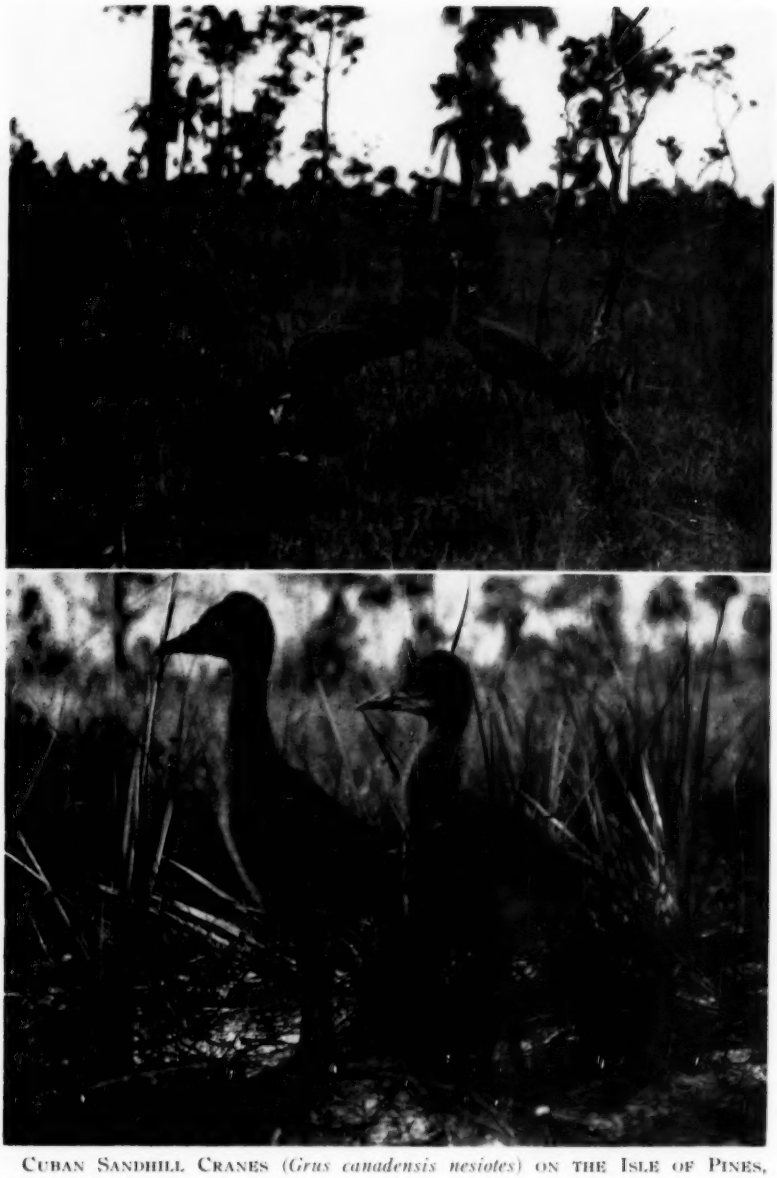

CUBAN SANDHILL CRANES (*Grus canadensis nesiotes*) ON THE ISLE OF PINES, CUBA. (*Top*) ADULTS AT NEST FOUR MILES SOUTHEAST OF LOS INDIOS, MAY 4, 1951. (*Bottom*) DOWNY YOUNG, TWO AND ONE-HALF MILES NORTH OF THE SIERRA DE LA CAÑADA, APRIL 28, 1951. PHOTOGRAPHS BY L. H. WALKINSHAW.

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ORNITHOLOGY

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NESTING AND ABUNDANCE OF THE CUBAN SANDHILL CRANE ON THE ISLE OF PINES

BY LAWRENCE H. WALKINSHAW

GUNDLACH first recorded the Cuban Sandhill Crane (*Grus canadensis nesiotes*) from the Isle of Pines, where he found it at Nueva Gerona (Poey, 1854: 427). Bangs and Zappey (1905: 193–194) first differentiated it from the cranes of North America, calling it *Grus nesiotes*, the type specimen having been collected at La Vega, Isle of Pines, Cuba, May 8, 1904.

Even though it has been a hundred years since Gundlach studied the crane in Cuba and the Isle of Pines, few nests have been reported. There are few actual egg or nesting dates. On eggs collected by early ornithologists, there is usually only the year and no locality except Cuba or Isle of Pines. On May 20, 1904, on the Isle of Pines, Zappey collected a downy Cuban Sandhill Crane only a few days old. Gustav A. Link (Todd, 1916: 208) observed a number of captive young on the Isle of Pines and judged that the eggs were laid early in May. When Bernard Baker and I were there during March, 1945, cranes behaved as though they were nearly ready to nest. Peter Smellie, who lives near Sierra de la Cañada, reported to me that he had found a crane's nest during the last week in April about 1932. We observed a crane about a year and ten months old taken when downy during May of 1943 near Westport.

With only this information, Walter Tholen and I reached the Isle of Pines on April 22, 1951, hoping to locate one or more nests of the Cuban Sandhill Crane. We arranged to stay with Mr. and Mrs. Lewis Feeger about four miles northeast of Los Indios and within one mile of where I had observed cranes on March 20 and 22, 1945. Shortly after we arrived we were able to hire Albert Vincent who knows the island well. In his 1929 Chevrolet we covered many square miles which otherwise we would have been unable to visit. We also had help from

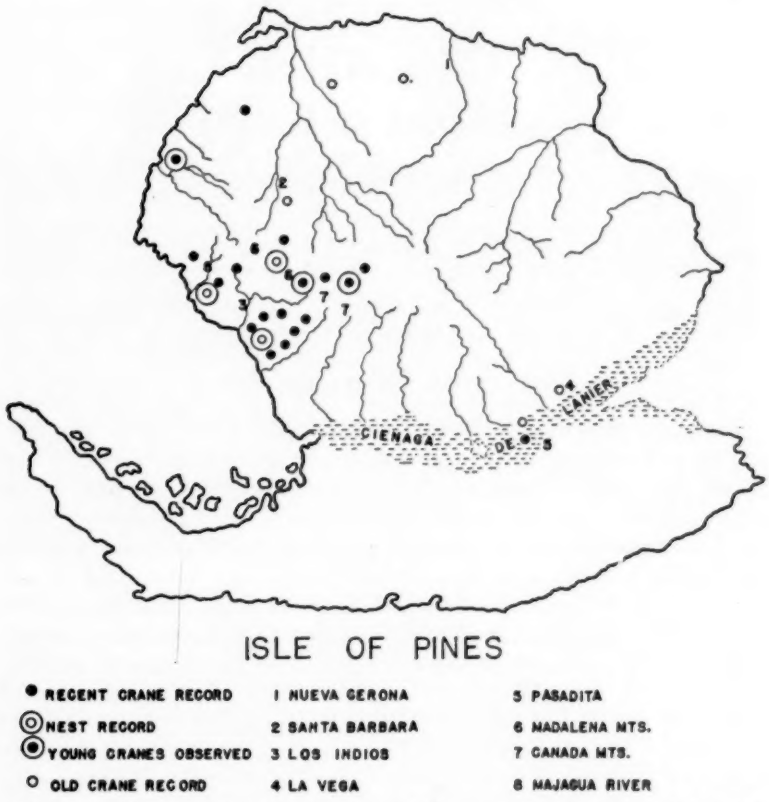


FIGURE 1. Map showing localities from which cranes have been reported on the Isle of Pines, Cuba.

Peter Smellie and Lawrence Hedin of Los Indios and many Cubans who lived in that area. Juan Arenciba, at Nueva Gerona, had three captive cranes in his collection. One of these was taken by two small boys from a nest on a mountain side near Los Indios during the first week in July, 1950. The Herman Nurse family rescued the young crane from the boys and gave it to the Tom Nurse family who finally gave it to Arenciba. When we saw it April 24, 1951, it still had the feathered forehead and the *peeep* call of a baby crane.

SUMMARY OF GENERAL DISTRIBUTION

A summary of the distribution of the Cuban Sandhill Crane is given in my book on the Sandhill Cranes (1949: 184–185). There are few recent records. Dr. Abelardo Moreno observed a single crane in

Pinar del Rio Province, Cuba, flying over the Viñales Valley, January 7, 1951. Dr. Moreno, Walter Tholen, and I drove to the Viñales area May 14, 1951. Natives reported cranes very rare. Two had been seen periodically a few weeks earlier, but we did not see these birds when we were there. Two birds shot by a farmer in Habana Province, near Ariguanabo, Cuba, during the winter of 1944 constitute our latest record from that province. The female specimen was sent to Dr. Moreno at the University of Habana. A specimen taken at Santa Tomas, March 11, 1933, now in the Museum of Comparative Zoology, is the latest specimen from Las Villas (Santa Clara) Province. We were in Zapata Swamp on May 10 and 11, 1951, but saw no cranes. We talked with natives in different parts of the swamp, and they said cranes were very rare except on two islands, Cayo del Masio and Cayo de Diego Perez, both immediately south of the mainland of the Zapata Peninsula. We were unable to visit these islands, but several natives reported cranes from them. Apparently there are no recent crane records from Matanzas and Camaguey.

In earlier times cranes occurred on the Isle of Pines from Nueva Gerona south to Pasadita and La Vega and west to Siguanae and Sabana Grande. Now the species is restricted almost entirely to an area from Westport east to Sierra de la Cañada and south to Pasadita where now it is rare. Almost all of the cranes are found from Rio Majagua to Sierra de la Cañada south probably to the Cienaga.

ABUNDANCE

There were five pairs in the ten miles between the Feegers' home and Sierra de la Cañada. We estimated four pairs along the Rio Majagua region, about four miles northwest of Los Indios, and we heard eight pairs calling one morning about four or five miles southeast of Los Indios. A flock of five was seen at Rio Majagua during April, 1951, by Lawrence Hedin and Albert Vincent. At Pasadita natives stated cranes were very rare, coming into the Cienaga de Lanier only occasionally. They said the cranes never bred in the Cienaga but nested on dry land; this was also stated by the residents in the Cienaga de Zapata, Cuba.

Gundlach (1875: 293) stated that the Cuban Sandhill Crane was common on some of the larger savannas of Cuba. He had observed it in the Cienaga de Zapata, as well as in the larger areas which were overgrown with conifers and oaks, but otherwise only in little-wooded places in the westerly parts of the island of Cuba and on the savannas of the Isle of Pines and of Central Cuba. In Cuba the crane has almost disappeared. Probably only a few birds survive, unless the

population on the two islands south of the Zapata Peninsula is greater than we believe. Albert Vincent has worked over the western end of the Isle of Pines for many years, collecting dead portions of the palms for burning ore in the gold mine. He probably knows better than anyone the whereabouts of the cranes, and he estimated a population of 100 cranes on the Isle of Pines, as did Goya, the owner of Sabana Grande where cranes occur in small flocks of three to seven during the winter but seldom are found in summer. He reported that a hunting party had shot six during the winter of 1950–51 on Sabana Grande.

NESTING RECORDS

Nest one.—Mr. Hedin reported to us the evening of April 22 that each morning about daylight cranes called on top of the mountain peak directly west of Mt. Hatillo in the Sierra de Madalena. We reached there before daylight April 23, 1951, and watched from this peak. Sunrise came at 6:16 a. m., and Walter Tholen, trying to photograph the sunrise, moved a short distance along the peak. At 6:19 a. m., not 60 meters from us, two cranes, previously motionless, started running and giving the loud alarm note, *groooa-groooa-groooa-groooa* over and over. Neither bird flew for some time. I started toward them, and both flew about us calling loudly. The larger crane had a lower pitched call; the smaller, a much shriller call. They landed about 100 meters from us along the less wooded portion of the mountain, and one crane, with outspread wings and lowered neck tried to distract us. The nest was almost on top of the mountain and surrounded by scattered tropical pines (*Pinus tropicalis*) and one lone bush (*Tabebuia lepidophylla*). Large rocks jutted through the thin soil, and on a flat rock amongst these was the nest, perfectly level except for a slightly hollowed center. It was made entirely of pine needles and appeared as though the birds had whirled around and around on it, as I have observed cranes do. On one side was a built-up runway, 9 cm. wide and 56 cm. long, of pine needles between the sharp rocks. The nest proper measured 96 by 134 cm. across and was 8 cm. thick. Inside were many small irregular pieces of egg shells about 5 to 18 mm. in width, evidence that the young had hatched. We did not find the young who must have scampered over the steep northwest side of the mountain only three meters west of the nest. Both adult cranes appeared to have spent the night on top of the mountain, one on the nest and the other five meters away. The nearest arroyo with water was about 300 meters from the nest.

Nest two.—About a mile east of the first nest we heard a crane call on April 23, 1951, at 7:00 a. m. On April 26 at sunrise (6:14 o'clock)

from the Feegers' house, I heard two cranes calling to the south in the Madalena range. One called, *toya-toya-toya* and the other, *tucka-tucka-tucka-tucka-tucka-tuck*. I started out in their direction at 8:30 a. m. From the mountain top I heard two cranes call at 9:30 a. m.; they were below me and to the east. I could not find anything, so I criss-crossed back and forth many times over the range. Suddenly a crane appeared on the south slope and uttered a sharp alarm call. I could find no nest, but the bird did not fly. A larger crane appeared on foot, and the two paced back and forth about 45 to 50 meters from me. One bird picked up objects from the ground and threw them about or dropped them back on the ground. Because of their behavior, I felt certain they had young; I gave the *purrrr* call given by the adults when calling young to them. Almost immediately, even with the adults bugling their disapproval, a downy crane rose from the gravelly ridge only 15 meters from me and ran in my direction, *peeping* as it came. Another was heard at the same time, but I could not locate it. The first one was rather wobbly on its legs, which were swollen and puffed like those of newly-hatched cranes. It had lost its egg tooth, could stand full height without falling, and must have been about three or four days old. It stood 23 cm. tall and the wing measured 36 mm.; the exposed culmen, 26 mm.; the middle toe, 35 mm.; and the tarsus, 51 mm. The call was a sharp *peeep;* and when captured, while resting in my warm hand, it uttered a *peeer* call. I searched the region for water, finally finding a small water hole about one meter across. It was only a few meters from where the cranes first appeared and the only water for miles, all arroyos being dry. I crossed this region the next day, but no signs of the cranes were found.

Nest three.—On April 28, 1951, Peter Smellie, his son Billy, Lawrence Hedin, and I hiked north of a low rolling brushy plain north of Sierra de la Cañada. In this region Peter Smellie had found two crane nests during the early part of the dry season, both in bottle palm (*Colpothrinax Wrightii*) flats along grass-bordered arroyos but on dry ground. The one found in late April, 1948, had two newly-hatched young. About 2.4 kilometers north of Sierra de la Cañada we observed two adult cranes walking about on a flat area. As we went in their direction they became very excited, running about but keeping some distance away. They were very wild. Soon they left the ground, calling as they flew. They landed on the other side of a palm-bordered arroyo some distance from us. We searched the area and soon captured two downy young. The stronger one could stand upright and could run very fast. The weaker one often fell, and his feet and legs were swollen, much like those of the downy crane I had

captured a few days earlier. Neither bird had an egg tooth. The following measurements were taken:

Height	*Wing*	*Exposed culmen*	*Tarsus*	*Middle toe with claw*
22 cm.	42.5 mm.	37.5 mm.	60.5 mm.	41.5 mm.
20.5 cm.	37 mm.	33 mm.	51.5 mm.	37 mm.

Before we left the vicinity, another pair of cranes flew over, joining the parent pair, and all four circled about together for a few minutes. Seldom have I seen two pairs of cranes together like this during the breeding season.

Nest four.—On April 25, 1951, Albert Vincent took Walter Tholen and me to a region, called Majagua, northwest of Los Indios. A small stream flowed into the Ensenada de la Siguanea only a short distance away. Five cranes had been seen two weeks earlier on a sandy area poorly covered with vegetation. We arrived before daylight and, as daylight came, heard two cranes calling only a short distance from the trail along a bottle-palm-bordered arroyo. Near a similar arroyo, less than a mile to the west, we flushed two more cranes; thus during the morning we counted six cranes. Thinking there might be a nest in this region, Tholen and I camped there the night of April 29–30. At 6:30 o'clock the night of April 29 two cranes called only a short distance from our tent. Sunset came at 6:57 o'clock. On April 30 at 5:35 a. m. two cranes called again in unison from the same spot. At the same time two pairs and a lone crane called to the south and east. After a short time Tholen and I went in the direction of the pair near the tent and in only a few minutes flushed a screaming crane from a nest, again in a perfectly dry location. The crane flew about 23 meters and landed. It ran crazily about us with outspread wings and bent legs. It did not fly again during our stay. The mate did not appear, having perhaps left at daylight for a feeding area. The nest was 75 meters west of an arroyo which had had water in it all spring.

The nest was on perfectly flat dry ground. One meter to the east was a small tropical pine four meters tall. In this same region were scattered pines including a few *Pinus caribaea*. Bottle palms grew along the arroyo, and up nearer the nest were palmettos (*Acoelorraphe Wrightii*) and scattered low bushes, including *Hypericum styphelioides*, rompe ropa (*Tabebuia lepidophylla*), peralejo (*Byrsonima verbascifolia*), *Ouratea elliptica*, *Kalmiella aggregata*, and some unidentified plants. The mangroves along the bay were only about 300 meters to the southwest.

The nest, poorly constructed, was made almost entirely of needles of the tropical pine (*Pinus tropicalis*). It measured 98 by 56 cm.

across and was slightly hollowed. The eggs lay in the nest about 7.5 cm. apart and were pale buff in color with small, fine spots of darker olive buff, dark brown, and lavender. These spots were scattered sparingly over the entire egg, but mainly around the larger end. The eggs measured 89 by 57.4 mm. and 82.6 by 53 mm. and weighed 158.2 and 108.1 grams, respectively.

Although we remained near the nest until 6:30 a. m., the adult crane did not fly. Wishing to photograph the nest and vicinity, we returned at 10:30 a. m., finding what was apparently the female sitting on the eggs. I had seen a lone crane flying east from the vicinity of the nest about 9:30 a. m. When the incubating crane left the nest, she flew around and around calling with a high-pitched voice. We did not return to this nest and so do not know its outcome.

Nest five.—When we returned to the Feegers April 30, word came that a Cuban, Avello Garcia, had found a crane's nest a few miles southeast of Los Indios on April 26. On May 1, 1951, Garcia rode by the nest at 7 a. m. The incubating crane rose and walked away. Garcia took us there at 8 a. m. The female was 150 meters southeast, walking about in the open pine-, palm-, and palmetto-dotted savanna. The nest was in the open, shaded a portion of the day by a tropical pine which stood three meters to the east. Scattered grasses grew about it. The palms (*Sabal*) were smaller than the bottle palm, much like the cabbage palm of Florida, and a few palmettos grew near by. The vegetation was quite similar to that in the region we had observed the previous day northwest of Los Indios, but the soil was not quite as sandy or as damp. The nest measured 62 by 48 cm. across and 5.2 cm. deep, was made entirely of needles of the tropical pine, and was on dry ground about 300 meters from the nearest water.

The eggs were much like the set observed on the previous day, being lighter colored and having fewer spots than eggs of *Grus canadensis tabida*. They measured 89.5 by 58 mm. and 85.5 by 53 mm. and weighed 129.8 and 97.0 grams, respectively.

That morning Garcia had observed another pair of cranes only a short distance west of this nest. The second pair behaved as though they had young. We did not observe them, but during the day we heard two cranes call at 12:30 p. m. and again at 5:45 and 6:21 p. m. (Sunset was at 7:03 o'clock.)

On May 3, Tholen, Vincent, and I built a blind at the above-mentioned nest, using palm and palmetto leaves and pine branches. The crane left the nest and paced back and forth about 200–300 meters from us. When we left at 9:50 a. m. the other crane came flying in, and both birds paced back and forth, bugling periodically; the lone bird had made no noise at all.

On May 4, Tholen and I went into the blind at 4:50 a. m. Even though it was dark, the female crane left the nest and did not return until 10:26 a. m. As she left, she uttered one shrill call.

The following notes were taken May 4 from the blind:

5:25 a. m.—Female called and was answered by the male (lower call) about 150 meters north of nest. At the same time another pair called less shrilly and less anxiously than the nest pair. One of these called *toya-toya-toya-toya* and the other at the same time *tuk-tuk-tuk-tuk*.

5:25–5:34 a. m.—Cranes called repeatedly from three places.

5:58 a. m.—Cranes again called from three places.

6:07 a. m.—Sun rising. 6:09–7:10 a. m.—Cranes called throughout area so that we could differentiate eight pairs. Nearby the nest pair called occasionally.

8:15 a. m.—The smaller bird, the female, came on foot to within 15 meters of the nest, examined it, then turned back just as swiftly, and both called at 8:20, 150 meters northwest.

10:26 a. m.—Nesting cranes called and flew from northeast to within 50 meters of nest. The female walked right to the nest, turned the eggs and then sat down on them. The male started slowly around the blind, head erect, and watching for motion from the blind. Both birds were very alert. After completely circling the blind the male stopped in a spot shaded by the trunk of the tropical pine near the nest but still watched the blind. While he was inspecting the blind he uttered a low *purrr* call to the female who answered with a similar call. The nest was in shade, but the female had her bill open because it was hot.

10:55 a. m.—Male alert at times, preening at others.

11:02 a. m.—Male began another circle around the blind, uttering a low *purrr* and was again answered by the female.

12:00 noon.—Female rose one-half minute, then settled down again.

12:20 p. m.—Male approached. Female uttered a low *purrr* as he approached and pecked gently at the side of the nest. She was sitting in the hot sun. The male walked past her into the shade five meters east of nest.

12:35 p. m.—Male stretched right wing and leg, leaving the leg out for nearly two minutes as he preened.

12:47 p. m.—Male left his shady spot and wandered to the west.

12:58 p. m.—Female pecking at her back.

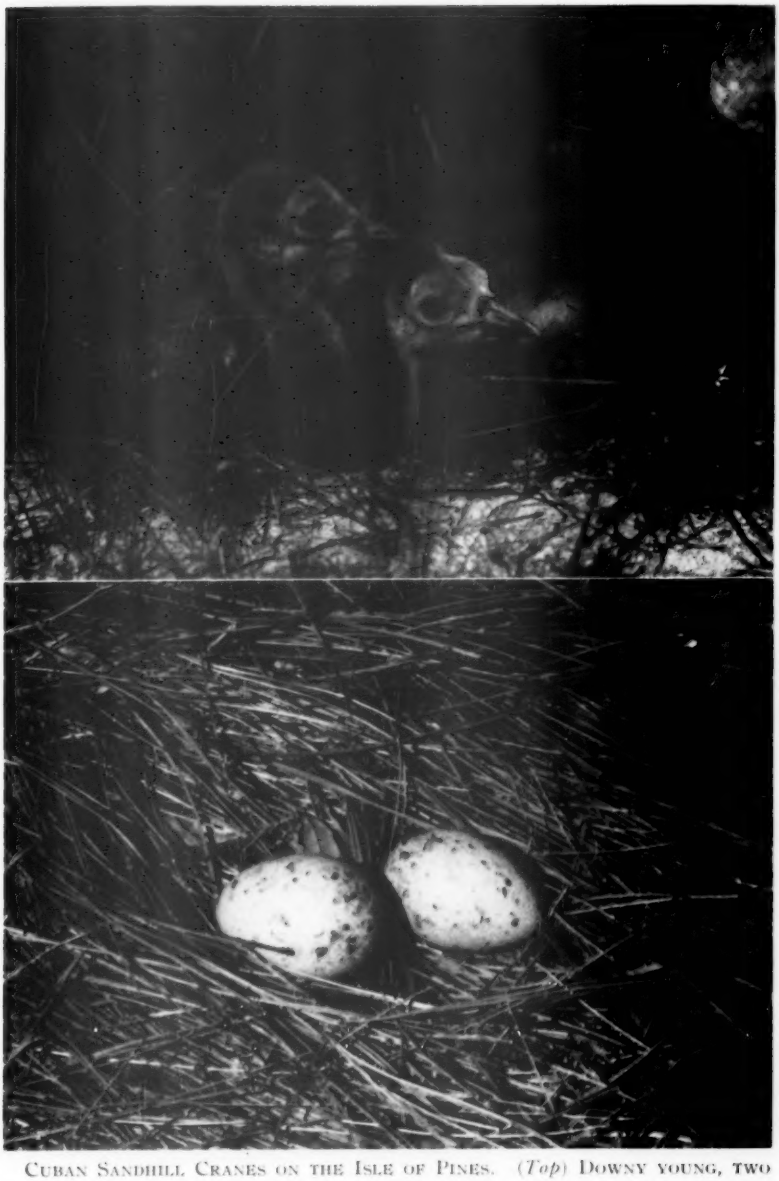
1:39 p. m.—Female began pecking at edge of nest. Male was approaching from west. She rose and both called in unison, the male with his bill at an angle of about 45°, *put-tuck—put-tuck—put-tuck;* the female, with her bill straight up, called *grooa-grooa-grooa*. The male then went to a shady spot four meters from nest. Female sat down on the nest facing south. She had been facing east. When the nest pair called, another pair called to the west.

1:56 p. m.—Female began to utter a low *purrr*, repeating it several times. Male walked toward the nest. Female rose and turned the eggs. The male came up back of her and to her right. She left the nest going rapidly to north on foot until she was out of sight. Male stayed up one minute and then sat facing south. He had a much redder bald spot on his head and his plumage was brighter.

2:20 p. m.—Male rose one minute and then sat facing west.

4:42 p. m.—Male had not moved his body for over two hours, now he rose and walked one meter from nest then returned and resumed incubating, facing west.

5:11 p. m.—Male again rose, walked one meter from nest, and then came back and sat down. Each time he was up about one-half minute and each time he turned the eggs.



CUBAN SANDHILL CRANES ON THE ISLE OF PINES. (*Top*) DOWNY YOUNG, TWO AND ONE-HALF MILES NORTH OF THE SIERRA DE LA CAÑADA, APRIL 28, 1951. (*Bottom*) NEST AND EGGS, FOUR MILES SOUTHEAST OF LOS INDIOS, MAY 1, 1951.

NESTING SITES OF THE CUBAN SANDHILL CRANE ON THE ISLE OF PINES. (*Top*) FOUR MILES SOUTHEAST OF LOS INDIOS, MAY 1, 1951. (*Bottom*) IN THE SIERRA DE MADALENA, FOUR MILES NORTHEAST OF LOS INDIOS, APRIL 27, 1951.

5:50 p. m.—Male left the nest in search of food and apparently was afraid of movie camera in blind. He had paid no attention to two still cameras. He walked to the female who was about 150 meters southeast of nest and both called—the male, *tuk-tuk-tuk-tuk* and the female, *grooa-grooa-grooa*.

6:30 p. m.—We left the blind and the cranes flew up not far from nest.

6:35–6:50 p. m.—Cranes called in many places, usually pairs calling in unison.

6:55 p. m.—Sun setting.

6:57 p. m.—One pair of cranes called in unison.

7:18 p. m.—Cranes near by again called in unison, as we left the area.

SUMMARY AND CONCLUSIONS

In Cuba the Sandhill Crane continues to decrease and is becoming exceedingly scarce. A few are still to be found in Pinar del Rio, and natives reported them from Cayo del Masio and Cayo de Diego Perez south of the Zapata Peninsula, Las Villas Province.

On the Isle of Pines between April 22 and May 7, 1951, I observed 48 adult and 4 downy Sandhill Cranes. An average of 0.30 cranes was observed per field hour for 176 hours, 3.25 cranes per day in the field for 16 days, and on 56.25 per cent of the 16 days (observed on 9 days). When I was on the Isle of Pines during March, 1945, I observed 7 cranes during 63 field hours, an average of 0.11 cranes per hour, only 0.59 per day in the field and on 16.66 per cent of days in the field, *i. e.* 2 of 12 days.

Although the increase during the six years was not that great, probably, cranes have increased on the Isle of Pines. Two natives with much field experience said the cranes had increased considerably, and both estimated, independently, that there were at least 100 cranes on the island.

Cranes are found north of the Cienaga de Lanier from near Siguanea north to Sierra de la Cañada and west to Westport (directly west of Santa Barbara), less often east to Pasadita and in winter to Sabana Grande.

The author observed three nests of the Cuban Sandhill Crane within five miles of Los Indios, Isle of Pines, and two pairs with downy young near Sierra de la Cañada. Two eggs were laid in nests on dry land, once even on a mountain peak. Three nests were made almost entirely of needles from the tropical pine (*Pinus tropicalis*). Egg laying apparently occurs between late March and late April. Three hatching dates in 1951 were about April 20; another nest had eggs on April 30. Native boys found a nest with hatching eggs the first week of July, 1950; as evidence the captive young, still with feathered head, gave the juvenal call in April, 1951.

Downy young resemble those of the other Sandhill Cranes in color. They leave the nest within 48 hours after hatching. One of the re-

quirements on crane territories is a spring or arroyo with some water. Isolation, as usual, is absolutely necessary; but whereas other Sandhill Cranes nest in open marshes, the Cuban subspecies prefers dry land. Eggs resemble those of other Sandhill Cranes but are lighter buff in color, have smaller spots, and are smaller in size.

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1703 Wolverine Tower, Battle Creek, Michigan, July 3, 1951.

INTER-FAMILY DOMINANCE IN CANADA GEESE

BY HAROLD C. HANSON

SEVERAL factors combine to make the social habits of geese among the most interesting and complex in bird life: the slowness with which individuals become sexually mature and the resultant age stratification in the population (juveniles, yearlings, nonbreeding adults, and breeding adults); their high degree of gregariousness except during the breeding season; their strong sense of territory or "property rights" (Richdale, 1951); and the persistence and the strong cohesion of the family group from one breeding season to the beginning of the next.

In the course of field studies of Canada Geese (*Branta canadensis interior*) at Horseshoe Lake, Illinois, in 1944 and 1945, a number of observations was made on the social behavior of these geese, particularly of family groups. Some of these observations were based on banded birds of known age and sex, but no real problem was involved when unbanded birds were observed at close range, as it was seldom difficult to distinguish the members of a family group—the juveniles from older birds by their appearance and color of their plumage, body contour, size, and behavior; the adult males from the adult females by their stance, size, and behavior. The observations recorded here are not extensive, but they may offer a new insight into the relationships between goose families. The concept presented needs further testing and clarification, and it is hoped that other workers on geese will deem it worthy of further investigation with marked birds.

Probably under most conditions of nesting in the wild, Canada Goose families seen in the autumn and winter represent pairs and their young of the year, but as so often occurs in nature, important exceptions exist. In Utah and southern Idaho where Canada Geese nest under practically colonial conditions, the integrity of the families is often lost through the combining of several broods which are then cared for by one or two mated pairs (Cecil Williams, pers. comm.). In the Mississippi flyway, family groups of Canada Geese are believed to represent mated pairs together with the original young (Hanson and Smith, 1950). It is not likely that inter-mixing of broods occurs after the young are about a week or more old. While some intermixing of broods of Canada Geese may occur on their Mississippi flyway breeding grounds, the result is the same—small "families" of limited size (nine or less) whether the young belong to the adults or are adopted.

One who has had the opportunity of observing Canada Geese at close range on their wintering grounds will be impressed by the amount of "quarreling" that takes place among the various family groups.

This is particularly evident when there is competition for food—the number and intensity of contacts among families being proportional to the degree of crowding. For example, the artificial manner in which grain is fed on refuges undoubtedly stimulates the frequency and intensity of contacts between families and other groups. The word "contact" is used here as a general term for all frictional encounters between goose families and between families and other age and sex groups. These contacts may consist only of threatening postures by either the gander or the female or by the entire family.

TABLE 1

OBSERVATIONS ON DOMINANCE IN CANADA GEESE IN CONTACTS BETWEEN FAMILY GROUPS OF DIFFERENT SIZE AT HORSESHOE LAKE, ILLINOIS

Size of inferior groups	*Number of contacts won by dominant families of varying sizes*							
	2	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	1	2						
2		1		1				
3		1				1		
4					2	1		
5				1	1	2		
6				1		3	1	
7							1	
8								
9						1		

Posturing in itself by a dominant family may suffice to cow other birds or families away from their path or intended food; on other occasions when posturing alone fails, the ganders may engage in all-out combat which at times is decidedly vicious. When several pairs of ganders are involved in combat at one time, the picture presented is chaotic indeed, it being almost impossible to relate the combatants to their respective families.

For a time it was thought that the apparent body size of the ganders might have at least some influence on the outcome of either "threat contacts" or actual combats, as there is considerable variation in their weight (Elder, 1946) and size (Hanson, 1951); but this theory was found to have little basis in fact, and as Allee (1951: 141) has pointed out "There seems to be little if any correlation between greater weight and position in the peck order." Instead, detailed observation suggested that the number of individuals in the contesting families constituted an important consideration, a large family generally dominating a family of lesser numbers (Table 1).

The psychic makeup of the ganders leading the family groups is of course important, but it does appear reasonable and certain that the number of members in the family group influences the responses of that

family toward other families. In brief, there appears to be "awareness" that in numbers there is strength, but a more concise interpretation of dominance in goose families might be that the presence of the brood acts as a generalized social releaser for the adults, which assures the continuation of the territory response in the parents through the winter period and that the strength of the stimulus for the territory response, as expressed by relative degrees of dominance, is roughly proportional to the size of the brood.

One striking example of this apparent relationship was observed repeatedly in 1946. A family of eight for several weeks frequented one of the traps; the two adults had been banded in previous years and several of the young just prior to recognition of the family as a whole. Later the remainder of the young were banded, and on one occasion the entire family was trapped. All received large numbered celluloid bands in addition to the regular aluminum bands; in the case of the young the bands were colored to denote they were birds of the year. On several occasions when part of the family was trapped in the evening, moved to another part of the refuge, held overnight, and released the next morning, these individuals would again be seen reunited with the remainder of the family the second evening at the original trapping site. They constituted the largest family frequenting the baited area about the trap, and wherever they moved all other geese gave ground without opposing them. A number of times they were observed 75 yards from the trap but definitely headed for it. On these occasions they were seen to make a hurried, direct, purposeful approach and several times when still 50 yards away the entire family came on at "dead run," all with open bills and outstretched necks, and the gander leading, the others stretched out on either side. Many yards before this formidable charging phalanx reached the baited area, the geese already there retreated without contesting the field. The large family seemed instinctively and unhesitatingly to realize its dominance over other families and miscellaneous aggregations; the latter in turn also appeared to recognize this dominance.

Jenkins (1944: 35) was the first to describe the moving and feeding territories so evident in goose flocks. As he has so appropriately pointed out, a "well-integrated family might be called a family supra-organism, since it performs the activities of a larger, more complex individual through coordination of its components. This results in the dominance of the family, which is survival value to its members . . ." When hunted by man, however, it has been shown (Hanson and Smith, 1950) that such intra-family dependence is not always of survival value.

There is much yet to be learned about the hierarchy among the families and other age and sex groups. Observations at hand indicate that the families are dominant to any other type of aggregation of these geese. For example, citing directly from field notes: "Nov. 13, a family of seven, four of which are banded, take possession of a small waterhole with a rush, scattering eight other geese. These appeared to be pairs and miscellaneous singles. Nov. 5, a family of three drives five other birds, but all of the latter appear to be yearlings or adults." Paired adults are probably next in the hierarchy to families; unmated adults (birds two and one half years and older) and yearlings (birds about 18 months old) may not differ greatly in their social position. Yearling birds sometimes appear to be almost as aggressive as many older single adults. A juvenile will threaten most other geese when it is a part of a family group; when alone or without their parents, juveniles appear to rank lowest of all age groups. According to Armstrong (1947) Lorenz found that in flocks of Grey-Lag Geese, *Anser anser*, the female attains the social rank of her mate and, indeed it may be added that in the case of Canada Goose pairs, so do the young of the year that accompany them.

Allee (1951: 152) has written, "The survival value of high position in the social hierarchy has not been demonstrated, but there are many reasons for suspecting that it may be felt in times of famine or during other periods of environmental stress." In the case of Canada Geese, it can hardly be doubted that the larger, more aggressive, dominant families are more secure when food is scarce and concentrated than are inferior groups. This would be particularly true in the case of the juveniles of dominant families; the adults, especially the ganders, spend much of their time and energy standing guard and vigorously chasing off the competing groups and individuals.

Noble (1939) has distinguished between sexual and social dominance, the former being a largely non-discriminatory emotional behavior, the latter being highly discriminatory and involving identification of actual individuals and relating them with their social status. Dominant behavior of goose families would appear to be related chiefly to "sexual dominance" rather than to social dominance, the aggressive behavior of the ganders with families being not discriminatory as to individuals, but directed toward all other groups of geese in general. Furthermore, in view of the important rôle psychic influences play in the reproductive cycles of birds, it would not be surprising if the "hormonal level" of the pairs with broods were to prove to be higher through the winter period than in the case of unmated geese or pairs without broods. This could very well be a result of the psychic stimulus received from the presence of their broods.

In conclusion, it should be emphasized that these general relationships appear to hold true for the autumn and winter period. At the onset of gonadal recrudescence in adults and the gradual attainment of sexual maturity in the young adults, a general realignment of the social structure in the population is to be expected. On warm days in late February and March, the geese at Horseshoe Lake exhibit an increased tendency to flock, and the large, unusually noisy assemblages of birds around the various ponds, relatively indifferent to food, are probably the outward manifestation of this realignment. Interest of the parents in their young of the year is diminishing by then and pairing by the newly sexually active adults is assumed to be taking place as well as the re-pairing of some of the older adults that have lost mates. There is considerable indirect evidence that pairing takes place chiefly on the wintering grounds or at least in the earlier stages of spring migration as the Indians on the breeding grounds state that the breeding birds are paired on arrival; this statement is also in accord with authorities who have witnessed the arrival of other species of geese on their breeding grounds. Also, the shortness of the breeding season in the far north would almost necessitate advance pairing.

The observations and conclusions reported here were discussed with Peter Scott in 1949. Since that time extensive studies involving thousands of observations of the social relationships of the white-fronted goose have been carried out by the staff of the Severn Wildfowl Trust. Scott (pers. comm., 1952) reports that their studies substantially confirm the concept advanced here.

SUMMARY

It was observed that a peck-order system exists among the Canada Goose families wintering at Horseshoe Lake, Illinois. The limited number of observations available have further indicated that the main factor influencing dominance among Canada Goose families containing different numbers of individuals is simple superiority of numbers.

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Illinois Natural History Survey, Urbana, Illinois, February 26, 1952.

A CENSUS OF THE KIRTLAND'S WARBLER

BY HAROLD MAYFIELD

THE Kirtland's Warbler, *Dendroica kirtlandii*, was discovered on May 13, 1851, when a migrant was taken at Cleveland, Ohio. The first nest was located on July 8, 1903, near Red Oak, Oscoda County, Michigan. Every nest found subsequently has been within 60 miles of the first. In winter, the bird is known only in the Bahama Islands.

We do not know with certainty whether there are more or fewer today than in former years. However, our scanty clues suggest that there may have been a substantially larger population in the 70's, 80's, and 90's of the last century. In that era, collectors in the Bahamas seemed to have little difficulty in gathering specimens on most of the larger islands, but Josselyn Van Tyne and I were unable to find any Kirtland's Warblers on New Providence and Eleuthera, two of the islands formerly most productive, during a five-week stay there in January and February, 1949.

METHOD

In the case of most species of songbirds the task of counting all the singing males would be formidable. But with Kirtland's Warbler this project seemed feasible because of several favorable circumstances:

1. In the nesting season the bird has never been found outside the pine country of the Lower Peninsula of Michigan.

2. All the nests and summer birds have been found in nearly homogeneous stands of small jack pines, *Pinus banksiana*, between the heights of 5 feet (about 7 years old) and 20 feet (about 20 years old).

3. In the forenoon if the weather is mild (not windy, cold, nor raining hard), the male sings rather steadily at a rate of five to nine songs per minute, with occasional silent periods that rarely last over one-half hour; the song is loud enough to be heard a quarter of a mile away on a quiet day.

4. In Michigan there are many competent observers who know the bird and its habitat.

We started with a region about 90 miles square—from Clare and Gladwin counties on the south to Cheboygan and Presque Isle counties on the north; from Kalkaska and Missaukee counties on the west to Lake Huron on the east. But much of this land—farmland, swamp, and deciduous forest—was ruled out quickly. The promising areas were located by use of the following information:

1. Nesting sites of recent years.

2. Jack pine plantings in the state forests and Huron National Forest between 1925 and 1945.

3. Forest fire records in the state forests and Huron National Forest between 1925 and 1945.

4. Forest-cover maps of the Huron National Forest.

5. Advice from state conservation and forestry men.

As a result of this preparation, we were able to single out 1200 surveyor's sections (square miles) for specific attention. These and nearby areas were apportioned among the cooperators; most people were assigned to areas with which they already had some acquaintance.

In the spring of 1951 each cooperator was sent a map of his assignment and a set of suggestions for counting and for submitting results. All counts were made in June, 1951.

RESULTS OF THE CENSUS

The total count was 432 males. Allowing for all possible sources of error, I believe that the total number of birds, male and female, is almost certainly less than 1000. (So far as we know, the males and females of this species are about equal in numbers.)

The summary by counties follows.

	Males	*Townships*	*Sections*
Crawford	142	7	19
Oscoda	103	6	19
Iosco	74	8	20
Montmorency	43	2	11
Presque Isle	34	2	13
Kalkaska	28	1	6
Roscommon	4	1	2
Alcona	4	1	1
	432	28	91

Counties searched systematically without results were Clare, Gladwin, Missaukee, Ogemaw, Otsego, Alpena, and Cheboygan.

In addition, Lawrence Walkinshaw inspected without results several areas of jack pines in four counties farther west, Grand Traverse, Wexford, Manistee, and Lake.

The airline distance from the southernmost to the northernmost bird was 64 miles; from the westernmost to the easternmost, 78 miles. The study showed that this warbler is at present largely a bird of the Au Sable River drainage; the only major exception is the group of birds on the border of Montmorency and Presque Isle counties.

The results in greater detail are filed at the Museum of Zoology, University of Michigan, where they are available for study.

This study has brought to light some facts about the Kirtland's Warbler that were outside the central aim of the census.

Area.—Although many people have remarked previously that the bird has not utilized nearly all the seemingly suitable habitat, we have

not appreciated before how large a tract of land with suitable cover is the minimum utilized by nesting birds. From the data supplied thus far, there is only one record of Kirtland's Warblers on tracts of less than 60 acres and there are very few on tracts smaller than 80 acres (that is, if rectangular, one-half mile by one-quarter mile).

I examined one strip of jack pines one and one-half miles long and 150 yards wide, with an abrupt transition to totally unsuitable area at the edges. It contained no Kirtland's although there were many colonies in seemingly identical cover in the same township. My only explanation is that this strip was too narrow.

The large "minimum area" is all the more surprising in view of the fact that the territory of a singing male is only one to four acres, and the male and female rarely leave their own territory during nesting season.

In the sections that contained birds, there was an average of 33 acres of apparently suitable land for each singing male (based on data supplied for 319 males on a total estimated acreage of 10,710). In Oscoda County the colonies I examined averaged one male for each 29 acres of plantings.

Colonies.—This study has confirmed that Kirtland's Warblers occur usually in "colonies." An isolated pair is a rarity and usually represents a remnant of a declining colony.

I suggest that "colony" be understood to mean a group of birds nesting near enough to one another that a person (and presumably a bird) in one male's territory can hear the song of at least one other male of the same colony. Frequently, the individual territories are not actually contiguous.

Minimum size of jack pines.—This study revealed that Kirtland's will sometimes make use of an area where the trees are quite small. In one locality a fire in 1945 burned more than 4000 acres of large jack pines. In the summer of 1951 several square miles of this burn were covered with a spontaneous growth of jack pines, few of them over three feet and many of them under two feet in height. A sprinkling of pairs and at least one nest were found here. This must have been the first year for the colony, five years after the first trees sprouted. (In a planting the trees usually are two or three years old when put out.)

Acceptance of red pines.—One of the most famous attributes of the Kirtland's Warbler has been its supposed insistence on jack pines for nesting habitat. The study brought to light two colonies (one containing 12 males) in almost pure stands of red pines, *Pinus resinosa*. This suggests that the critical requirement is not the species of pine

but the configuration—pine thickets and small clearings. Red pines in natural stands seldom if ever grow closely enough together to form thickets.

Plantings.—A few years ago it was considered that Kirtland's Warblers nested only rarely in plantings (presumably because the clearings were insufficient). This year most of the birds found were in thickly-grown row plantings. But investigation may show that the birds reach their maximum density in a natural growth with many thickets and openings.

RELIABILITY

The principal possibilities of error in this study are colonies missed and birds missed in colonies discovered. I believe that the total error from both sources combined is less than 25 per cent. This is a guess. And there is also the possibility of offsetting errors from overcounts, particularly in colonies of a half-dozen or more birds.

There remains the remote possibility of nesting Kirtland's Warblers in Wisconsin, the Upper Peninsula of Michigan, and southern Ontario, but field work has not yet produced indisputable records in these areas.

The most important source of error, in my opinion, is the possibility of missing a bird by visiting its territory when it is not singing. However, available information indicates that the male is rarely silent for as much as 30 minutes and that in a colony of 6 of more birds there is rarely a silent period of 5 minutes—in a forenoon in good weather in June.

Participating in this project were 32 cooperators in 13 parties, as follows: C. T. Black; Wilbur Bull, assisted by Mr. and Mrs. E. G. Boyes; Irene F. Jorae; Eugene Kenaga and M. A. Wolf; Harold Mayfield, assisted by Mr. and Mrs. Dale Zimmerman; R. A. MacMullan, assisted by S. DiAngelo, E. M. Harger, and W. L. Palmer; Douglas Middleton, and Mr. and Mrs. Neil Kelley; Dr. Richard E. Olsen, assisted by Dr. Norman Gehringer and Dr. and Mrs. Harold Roehm; Ralph O'Reilly; Josselyn Van Tyne, assisted by Andrew Berger, Irving Burr, Philip S. Humphrey, Clarence J. Messner, Robert W. Storer, and Alexander Wetmore; Lawrence H. Walkinshaw; Harold Wing; Emma Wiseman.

People who gave valuable assistance without participating in the count directly were Verne Dockham, Donald W. Douglass, and F. J. Hodge, of the Michigan Department of Conservation, and Paul S. Newcomb and John O. Wernham, of the U. S. Forest Service.

2557 Portsmouth Ave., Toledo 13, Ohio, January 8, 1952.

NOTES ON THE LIFE HISTORY OF THE BLOOD-COLORED WOODPECKER IN SURINAM

BY FR. HAVERSCHMIDT

THE Blood-colored Woodpecker, *Veniliornis sanguineus*, is, according to Peters (1948:175), probably confined to the Guianas. In Surinam it is quite a common bird in the coastal area and particularly numerous in the coffee plantations. It also occurs in dry sandy country in the interior, where a relative, *Veniliornis cassini*, is also found.

The Blood-colored Woodpecker is a rather small bird. The weights of specimens collected in Surinam are as follows: four males, 24, 24, 30, and 30 grams; two females, 23 and 26 grams. In the male the head, entire back, and wings are bright red, and the entire under surface is blackish-brown barred with white. The tail is dark brown. The female differs from the male in having the crown and nape brown instead of red, and the under surface is paler brown (Chubb, 1916: 487). The birds are usually seen singly or in pairs and forage in all kinds of trees and even in shrubbery. Both sexes drum. In the large egg collection assembled in Surinam for the Penard brothers and now preserved in the Leiden Museum, eggs of this species are dated: February, and May through September (Hellebrekers, 1942:249–250). In this collection is one clutch of three eggs, six clutches of two eggs, and seven single eggs.

Excavating the hole.—On March 24, 1950, I found a circular hole about nine meters up in the dead stump of a tree in my garden, which is situated in an old, neglected coffee plantation on the left bank of the Surinam River just outside Paramaribo. A Blood-colored Woodpecker was foraging in the neighborhood but was not seen working on the hole at that time. On April 3, I observed a bird hammering at the hole. Hammering was seen daily from then on, but was carried on in a rather leisurely way and never for long at a time. On May 2 the hole had progressed so far that part of the bird was hidden in it. On May 12 only the bird's tail protruded from the hole, and on this day both sexes were observed taking part in the work. This lasted until May 20 when the bird at work entirely disappeared in the hole. On May 30 a bird spent a short time in the hole looking out. Although I did not observe the start of the building, it is clear from these notes that the excavation of this hole lasted for at least two months. To my regret this hole was not used for breeding but only as a roosting place.

Roosting.—Roosting was noted for the first time on June 10. About 6:00 p. m. two woodpeckers were observed busily foraging; suddenly

the birds copulated, the female sitting sideways on a branch like a passerine bird. Shortly afterward the birds entered the hole in quick succession and spent the night inside.

On June 24, I saw that three birds entered the hole about 6:15 p. m. Two birds arrived together and entered in quick succession. They were hardly inside when a third bird alighted at the hole and entered shortly afterward. Roosting by three birds was seen again on June 25, but owing to bad light I was still not able to discern the sexes. On July 8, I determined that one male and two females entered the hole to spend the night. From that date on, however, the hole was used for roosting by only two birds, presumably a male and female, although I never was certain about this.

Usually, but not always, both birds arrived in the neighborhood about 6:00 p. m., foraged busily, defecated, and then one bird alighted just under the hole and inspected the hole several times before entering. Then it looked out of the hole for some time, until the second bird alighted and took the same precautions before entering.

Roosting was from then a daily feature and was seen the last time on February 4, 1951. After that date the birds were not seen again, and it is possible that they bred somewhere in the neighborhood. In April the branch containing the hole was partly eaten away by termites and fell down.

This hole was used for about eight months as a roosting place. Briefly, at the beginning of this period, it was used by three birds; later it was occupied by two.

In his fine study of the Golden-naped Woodpecker, *Tripsurus chrysauchen*, Skutch (1948:257–258) gives a preliminary and partial classification of woodpeckers based on their life histories. I do not know of a life history study of any member of the genus *Veniliornis*. From my observation on the roosting of *Veniliornis sanguineus*, it appears that this species belongs to the group called by Skutch the "*Tripsurus* type," in which the adults occupy their sleeping cavities in pairs or family groups. Unfortunately I have no records on the return of young birds after fledging.

The nesting hole.—A hole, which contained young about a week old, measured as follows: diameter of entrance, 3 cm.; depth of hole from bottom to roof, 17 cm.; depth of nest chamber to entrance, 13 cm.; largest diameter of nest chamber, 6.5 cm.; diameter at bottom of nest chamber, 5 cm. The diameter of the tree at the entrance was 15 cm., and the height of the hole above ground was 1.37 meters.

Incubation.—On October 3, 1949, I found the nest from which I later took the measurements given in the previous section. It was in

a dead coffee tree in the plantation near my home. The female left the nest at my approach. It was apparent that incubation was in progress. On October 5, the female was in the hole from 6:35 a.m. until 7:00 a.m.; and during one hour of watching, from 1:45 to 2:45 p.m., the male was inside until 2:35 when the female arrived. She alighted on the tree a little below the entrance and hopped towards it. The male then left the nest and the female entered. The female repeatedly peeped out of the hole, her bill open.

TABLE 1

Date	*Time*	*Times fed by*		*Total*
		male	*female*	
October 11	3:55 to 4:55 p. m.	2	1	3
October 12	6:10 to 7:10 a. m.	3	2	5
October 13	1:24 to 2:24 p. m.	1	—	1
October 14	6:30 to 7:30 a. m.	1	1	2
October 16	6:10 to 7:10 a. m.	3	1	4
	7:10 to 8:10 a. m.	1	3	4
	8:10 to 9:10 a. m.	2	1	3

On October 6, the male was inside from 3:30 until 4:30 p.m., and on October 7, the female from 4:40 until 5:00 p.m. There was no nest relief during these periods. On October 8, I watched the nest from 3:15 until 4:15 p.m. The female was inside at 3:15. The male arrived at 3:45 and nest relief took place in the same way as before, the female leaving when the male climbed to the entrance of the hole.

The rearing of the young.—On October 11, it became clear that the young had hatched, because a rattling noise was heard in the hole. Both sexes fed the young in the hole, and the food was always visible in the parents' bills. It struck me that the amount of food taken to the young at each feeding was small. The adults' bills were never packed with clumps of insects as had been the case with two species of the genus *Dendrocopos* which I watched in Europe. My observations of the feeding of the nestlings during one-hour periods are shown in Table 1.

On October 13 at 1:35 p.m., I could distinguish only a single small caterpillar in the bill of the male when it entered the hole; and on October 16 while watching for three hours, I observed that three times only a single arthropod was taken to the young. Twice it was a caterpillar, and once a small spider. On this last day, I also observed once that the female left the hole with a clump of excrement in her bill after feeding the young. I presume the excrement was eaten by the adults when the young were smaller. It was amazing what a noise the small nestlings made in the hole. This went on nearly continuously, and the rattling sound increased when I passed the nest tree

and still more when I covered the entrance with my hand. This noise was presumably the cause of the disaster which occurred while I took a short walk after three hours of continuous watching on October 16. Upon my return, the hole was partly cut open, and in it were seen two naked young of a pinkish color. The floor of the nest chamber was quite clean and covered with a thin layer of wood pulp.

During the nestling period, as far as I was able to observe it, the female usually stayed with the young birds after a feeding, often peeping out of the hole until the male arrived with food. The male most often left before the female came, although he remained inside for a short period. The female left the hole when the male alighted a little distance beneath it, and I never observed both birds together in the hole. For instance, on October 12, the male fed at 6:12 and left at 6:15 a.m. The female arrived at 6:20 and remained in the hole until the male came with food at 6:39. The male then stayed until 6:44, looking out of the hole all the time. At 6:49 the female came once more and stayed with the young until the male arrived at 6:57. The male remained inside until 7:07. On the afternoon of the same day the female arrived at 4:19 and remained inside until 4:40. She returned with food at 4:45. On October 16, the female alighted on the tree at 7:55 a. m. and hopped to the entrance. Before she reached it, the male too arrived with a small caterpillar in his bill. The male waited until the female had entered the hole and had come out again. After the female had disappeared, the male entered to feed the young and left immediately afterwards.

SUMMARY

Notes on the roosting and nesting habits of the Blood-colored Woodpecker, *Veniliornis sanguineus*, in Surinam are presented. Both sexes drum. A hole was excavated by both sexes. It was used as a roosting place for at least eight months, in the beginning by three birds—one male and two females—and later by two birds of undetermined sex. A nesting hole in which incubation had been in progress for some time was found on October 3, 1949. Both sexes took part in incubation. After the eggs had hatched, both sexes fed the young in the nest. The food, consisting of insects, was taken to the young in the bill. Feces were removed, carried in the bill of an adult, on October 16. The nest hole was quite clean and contained two young. Measurements of the hole are given. According to these observations *Veniliornis sanguineus* belongs to the "*Tripsurus* type" in the classification of woodpeckers given by Skutch (*loc. cit.*).

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FACTORS AFFECTING FEEDING RATES OF ANIS

BY A. L. RAND

THE Groove-billed Ani, *Crotophaga sulcirostris*, is a black cuckoo of tropical America. Its habitat is brush and the adjacent grassland and open country. There, usually in small parties, it spends much time walking on the ground, or crawling through the brush looking for its food. This, according to Bent (Life Histories of North American Cuckoos, . . . , U. S. Natl. Mus. Bull. 176: 31, 1940), is largely insects, and to a smaller extent fruit and berries. Frequently anis accompany cattle and mules for the insects these animals frighten into activity. The extent to which anis perch on cattle and pick ticks from them is questioned by Skutch (*in* Bent, *loc. cit.*) who suggests the popular belief to this effect is due to confusing the ani with cowbirds which are also black. The ani has also been recorded as following army ants for the insects and other small animals driven from hiding by the ants. They also feed on winged termites, catching them in flycatcher fashion.

When in El Salvador from February to July, 1951, working at the Instituto Tropical de Investigaciones Cientificas of the Universidad Autonoma de El Salvador, at San Salvador, I made observations on the feeding rate of the Groove-billed Anis, which demonstrated quantitatively, first, the advantage in their habit of accompanying cows for the insects the cows scared up and, secondly, the increased abundance of their insect food in the wet season. Many of the data that are used below were collected by my son, A. Stanley Rand, who was my assistant in the field. That his data and mine are strictly comparable we demonstrated a number of times by both of us watching and recording the activities of the same bird.

Anis often feed in shrubbery and about tall grass clumps, where they are difficult to observe, but about San Salvador they also came out onto the grazed open pastures where they were easy to watch. There they had two main methods of feeding. One was by walking about looking for and snapping up insects sitting on the grass. Often the birds would stop and peer, as though near-sighted, at a tuft of grass or at a leaf. Sometimes as insects flew up ahead of a bird they were pursued; sometimes one bird would attempt to take the food from another bird or to seize an insect the other bird had flushed. The second method of feeding on insects in pastures was for the birds to accompany cattle, keeping either by the head or a foot of the grazing beast, and pursuing the insects frightened into activity by the cow.

The observations were planned to watch anis feeding without cows for several hours and then with cows for several hours, and to compare

the number of catches per hour under each set of conditions. But this proved to be more difficult than expected. Though the birds were tame, and we watched them through six-power glasses, even in the most open terrain it was difficult to keep an ani under continuous observation for many minutes. It would go behind a tussock or a shrub, or if with a cow, perhaps behind the cow's head. Sometimes after feeding actively for a few moments an ani would sit quietly, preening, or as if dozing, and when I was about to give up watching it, it would sometimes reach out and seize an insect. There was the question as to how long to wait before stopping observations on a resting ani. Sometimes anis fed much more actively than at other times, possibly due to difference in hunger. Finally, after considerable observation I decided that three minutes of active looking for food in normal habitat was the shortest time I would record, and the data recorded consist of many short observations of three minutes or more. I soon found that many of the anis' catches were of small insects and that I could not be sure whether or not a particular sortie had yielded an insect. It seemed advisable to record "trys" or attempts to catch prey rather than actual "catches." An exception was where more than one "try" was made in the same place in rapid succession. These were assumed to be made at the same insect and counted as one try. Sometimes an ani accompanied a cow on a dry, bare road where insects were almost absent. Such data were not included. The same criteria applied to each set of observations, and these are all comparable. When observations were started, it was thought enough data could be gathered in a few days, but it was necessary to gather scattered observations in the dry season, when the grass was short and slow-growing, and to continue them on into the wet season. Then the anis' feeding rate increased, and it became necessary to compare feeding rates seasonally. A summary of the data is presented in Table 1.

Feeding rate in relation to cows.—In the dry season when food is scarcer, an ani hunting alone and seizing the insects it finds sitting quietly on the grass or flushing ahead of it, finds only one-third as many insects as it does if it accompanies a cow and seizes the insects the cow startles into activity. In the wet season, when insect food is much more plentiful, there is still a difference in the results of the two methods of hunting, but it is much less. When insects were plentiful, it was noted that an ani might make a number of "trys" at prey in very rapid succession and then there might be a pause in its activities. Perhaps at higher levels of food abundance there is a slackening of the feeding rate due to "inclination" of the bird rather than to availability of food.

When anis hunted by themselves they covered a surprisingly large amount of ground, though their legs are short and their tails and even their bellies often seemed to drag on the grass. When with grazing cattle they moved about much less. Thus not only in greater returns for the time spent, but also in lesser energy expended, the habit of attending cattle is economical.

TABLE 1

FEEDING RATES OF ANIS

	Season	*Dates*	*Periods of observation*			*"Trys" to capture insects*		
			Number	*Extreme lengths*	*Total time all periods, in minutes*	*Total number*	*Extreme variation in number per period*	*Average number per minute*
A. Feeding rate *without* cows	Dry season	March–April 9	7	3–5	24	14	1–3	0.5
	Beginning of rainy season	April 13–May 9	4	3–14	29.5	43	6–21	1.4
	Rainy season	June	20	3–6	74.5	257	4–21	3.4
B. Feeding rate *with* cows	Dry season	March 13–April 6	6	3–12	30	45	3–13	1.5
	Beginning of rainy season	April 21–May 4	3	4–6	15	28	4–18	1.8
	Rainy season	June 23–26	7	3–5	27.5	132	9–31	4.7

The habit of attending cattle may be so fixed that it can be carried on when it is not useful. On March 27, an ani followed a cow on a dry dusty road for six minutes. Such a place is naturally nearly devoid of insects, and it was surprising that in these six minutes the bird did make one try.

The data as a whole demonstrate very clearly the advantages of a bird's using an animal as a beater, and it is not surprising that a number of other species, of widely separated orders such as the cowbirds (Family Icteridae) of America and the cattle herons (Family Ardeidae) of Africa and Asia, as well as the anis (Family Cuculidae) of America have evolved this feeding relationship with cattle. Other relationships, such as those of a hornbill (Family Bucerotidae) with a monkey in Africa, and a drongo (Family Dicruridae) with a monkey in the Indo-Australian area may be similar. The big, mixed flocks of insectivorous birds that are so common in the tropics probably have mutual benefits of a similar kind at work.

Though anis in this area were much attached to cattle for feeding, the association ended there. We never saw an ani perch on a beast.

And when the anis finished feeding, they left to perch in bushes or trees without reference to the cows. In these respects the ani is much less attached to cattle than are the cattle herons and the cowbirds which may perch on the cattle or rest near them. The cattle-ani relationship seems to favor the ani almost entirely. The extent to which the ani benefits the cattle here in El Salvador by picking off ticks is probably very small (see also Bent, *loc. cit.*). But once A. S. Rand saw an ani pick a conspicuous tick off a beast. The cattle in Salvador completely disregard the ani. The ani is careful only to keep from being accidentally touched by the grazing beast, and sometimes, as a grazing cow swung its head, it seemed almost to brush an attending ani with its nose, without alarming the bird.

It is also interesting that a species that habitually travels in parties of six to eight or more birds and follows army ants and cattle should have no feeding organization within its own flocks. Many species, including certain starlings, ground hornbills, cormorants, and pelicans feed close enough together so that individuals act as beaters for each other. One bird may scare away a potential item of prey that will flee into the maw of a neighboring bird. A similar habit would seem of advantage to the ani. With the ani, sometimes one bird will rush up and try to get prey away from another bird; but in general in feeding by themselves they scatter out with little reference to each other (except when paired), and there is no organization that aids them as mutual beaters.

Feeding rate in relation to season.—In March the pastures had short grass, much of it brownish, and growth was evidently slow; insect life appeared relatively scarce. With the beginning of the rains in April, growth was soon evident and the fields assumed a greener, more luxuriant look. Casual inspection showed grasshoppers and other insects to be much more common. This is reflected in the feeding rate as shown in Table 1. In feeding without cows the feeding rate in the wet season increased nearly seven times over that in the dry season. Feeding with cows the rate increased only about three times, but was higher than the rate without cows. This graphically illustrates the increase in abundance of insects in the wet season, and the advantage to the bird of nesting in the rainy season when food for the young is more abundant. (In June the condition of the gonads showed the breeding season was approaching, and eggs have been recorded in July and August.) Perhaps, as Davis (Auk, 57: 202, 1940) has suggested for the Smooth-billed Ani, *Crotophaga ani*, this change in food availability initiates breeding.

In Cuba the Smooth-billed Ani is said (Davis, *loc. cit.*) to change its food habits with the seasons; during the dry season it subsists largely

on fruit; during the wet season little vegetable food is taken. A congregation of birds about streams during the dry season has also been noted. In the Groove-billed Ani no such change was noticeable. Occasionally, in both dry and wet seasons, anis were seen in fruit trees, apparently eating fruit, and throughout the period of observation a nettle bush with small, white, watery fruit was occasionally visited and a few berries eaten. A meal was never made of these berries, and the birds sometimes flew 30 to 40 yards from where they were catching insects to the bushes to eat a few berries. It seemed as though the berries were sparingly eaten as a supplement to the diet.

As one might expect, in the wet season when more food could be gathered in a shorter time, anis spent less time hunting and were seen less regularly with cows and for shorter periods. Indeed, anis were generally less conspicuous in the wet season than in the dry, possibly because the birds, having to hunt less, spent more time quietly perched in shrubs and trees, which during this season have denser foliage.

SUMMARY

Groove-billed Anis, *Crotophaga sulcirostris*, were watched feeding alone and with cows in open pastures in both the dry and the wet seasons, and the number of "trys" to catch insects was counted. The advantage to the ani of accompanying cows and of using them as beaters and the increase in the available insect food from the dry to the wet season are demonstrated.

Chicago Natural History Museum, Chicago, Illinois, November 6, 1951.

ORIGIN AND STATUS OF THE HOUSE FINCH IN THE EASTERN UNITED STATES

BY JOHN J. ELLIOTT AND ROBERT S. ARBIB, JR.

On January 17, 1948, at Hewlett, Nassau County, Long Island, New York, an adult male House Finch, *Carpodacus mexicanus*, was collected by Arbib from a flock of 40 or more birds. This specimen (now No. 348793, Amer. Mus. Nat. Hist.) was the first House Finch collected in the eastern United States, and it proved that the species had been correctly identified as a resident—indeed, a breeding bird on Long Island—an assertion that had been maintained in the face of some skepticism during the previous five years.

Acknowledgements.—In seeking to unravel the mystery of the appearance and history of this western species in this new locale, the authors have been greatly assisted by the professional opinions and advice of Dr. Dean Amadon and Dr. John T. Zimmer of the American Museum of Natural History and Dr. Alden H. Miller of the Museum of Vertebrate Zoology. Information valuable to the study was generously supplied by John L. Bull, Jr., Edward Costich, Richard B. Fischer, Dr. Edward Fleisher, Charles E. Mohr, Richard H. Pough, and Lester Walsh.

History

The known history of the House Finch in the eastern United States begins with the first published record east of the great plains. This involved a highly-colored male bird discovered at Jones Beach, Long Island, on April 11, 1941, by Richard B. Fischer and Robert Hines. This record was published in a weekly column on local ornithology edited by Elliott and appearing in the 'Nassau Daily Review-Star,' a newspaper (Rockville Centre, N. Y., April 23, 1941). The bird was subsequently seen and heard on April 15, 17, and 20, 1941, by numerous observers, this being the only record from Jones Beach.

About a year later, in March, 1942, Elliott found seven House Finches in the vicinity of a tree nursery at Babylon, Long Island (about 12 miles northeast of Jones Beach) and lists the following records from that area: summer of 1942—small colony found on nursery grounds with several males singing from the tops of ornamental evergreens; summer of 1943—about a dozen birds present. On May 28, 1943, a nest with four young was found. This is the first recorded nesting in the area; July, 1944—about 18 birds present, and young being fed at perches on electric wires.

Numbers increased to 24 in 1945 and to 38 in 1946. One evening in late summer of 1947 a flock, closely estimated at 50 individuals, flew into the Babylon nursery area. In 1947–48, after a heavy snowfall, the Babylon colony seemed reduced to a very few birds; none could be found for a month, although previously they wintered there.

There were, however, several dozen birds in the summer of 1948, and these increased to 70 by the winter of 1949–50. At the time of the absence at Babylon in 1947–48, large increases were noted at Hewlett (23 miles west) and at Lawrence (26 miles west) where other colonies had definitely been known to exist since 1944, and possibly had existed earlier. At Westbury (12 miles northeast of Hewlett) House Finches were found in a large nursery in 1944, and these increased to several dozen in 1948, with young noted from 1945 on.

At this writing, the four colonies mentioned are all thriving, with slight increases indicated over the populations of 1949. In the last two years, increasingly frequent records have been obtained outside the Babylon-Westbury-Lawrence triangle, evidence of peripheral spread. Long Island locations include Riis Park, Idlewild, Williston, Roslyn, and Wyandanch. On May 18, 1948, the first unimpeachable record of a House Finch from off the island was made at Tarrytown, New York, by Lester Walsh, and there are subsequent records from Ridgewood, New Jersey (1949) and Bedford and Armonk, New York (1951). During the winter of 1951–52 a small colony (20–30 birds) was found along the Long Island shore in Greenwich Township, Connecticut.

ORIGIN

In May, 1947, Elliott wrote a brief summary of the status of the House Finch on Long Island (Linnaean News-Letter, 1 (3): 2). At that time there was no clue as to how the species had come into the East, why it had not been noted in other parts of the continent outside its normal range, and why all known colonies were concentrated on Long Island. Several theories were advanced, including the escape of cage birds, deliberate planting, and the possibility that some birds may have been inadvertently trapped in freight car shipments of nursery plants from the West. It seemed impossible that a characteristically sedentary, or at best only locally migratory species should suddenly appear in numbers, of its own volition, some 1,500 miles from its normal range without a single record from intervening areas.

An answer was immediately forthcoming, which at first seemed to solve the riddle of the birds' appearance, though it subsequently raised several corollary problems. The answer came from Dr. Edward Fleisher, of Brooklyn. Fleisher (Linnaean News-Letter, 1 (4): 1–2)

wrote that in January, 1940, he had discovered in a bird store in Brooklyn a large cage with 20 House Finches for sale as "Hollywood Finches." He had previously seen Bohemian Waxwings for sale in this store, and decided to put an end to this traffic in protected American passerines. In Fleisher's words:

> "I accordingly wrote to the National Audubon Society asking them to take some action. Mr. Richard Pough, who handled such matters, was out of town, and the case was referred to the State Game Protector of this district. I received, through the kindness of Carl W. Buchheister, a copy of this official's reply. In it he stated that the birds were sold by an aviary in California, and he intimated that the sale was not illegal because 'the species is not protected in California nor is it native to New York State.' . . . On March 14, 1940, I wrote to the then Bureau of Biological Survey and received a reply signed by Chester A. Liechhardt, Acting Chief of the Division of Game Management. In this letter, I was informed that House Finches were placed on the list of migratory birds following the convention between the United States of America and the United Mexican States, and hence their trapping and sale without a federal permit constitute violations of the law . . .
>
> Shortly thereafter I was visited by Mr. Orin D. Steele, U. S. Game Management Agent. In answer to one of his questions I strongly opposed releasing these birds in this area, and asked that they be disposed of in some other manner. A few days later, April 1, 1940, Mr. Steele sent me a letter in which he said 'based entirely on information furnished by you, we have been able to stop the trapping and transportation from California, and have stopped sales throughout the United States'."

Fleisher's report of his campaign is quoted at length because it puts on record the names of those most responsible for ending this illegal traffic, and because it illustrates the rewards of constant vigilance.

Meanwhile, the National Audubon Society had taken action locally. Pough had telephoned to 20 local dealers, and found that all carried the species, or had carried it at some time during the four years the treaty had been in effect. Three dealers said they "no longer carried House Finches . . . because they were too cheap . . . and because they were too wild and did not live long in captivity." Most of the local bird shops were supplied by one wholesaler, who confided to Pough that there was some present trouble about the legality of their sale, and until the matter was straightened out, he could not supply. He thought that in a week or two he could start shipping. He quoted a price of $35 per hundred. He said they would probably get around the difficulty by calling the birds Purple Finches, since, he said, these birds were not protected by the Mexican treaty.

In seeking to trace this illegal traffic, the authors canvassed bird shippers known to have engaged in trapping House Finches. Some were no longer in business, others refused to answer, but several replies were informative, and revealed an unsuspected magnitude of the operation. One shipper, located at Reseda, Los Angeles County,

California, stated that he had ceased shipping House Finches, known to the trade as "Red-headed Linnets" in 1936, but that many thousands of these birds were shipped by him and almost every other dealer to nearly every state east of the Mississippi. He stated that they were shipped so fast that the State Fish and Game Department put a ban on further shipments. (This may have been the ban imposed in 1940.) To quote him: "Some of the shippers shipped them regardless of the ban, but gave them different names. It is still unlawful to ship these linnets but some of the dealers still ship them under various names. Only about 100 females were shipped to every 1,000 males, the males being the colored ones. They used to breed these males to female canaries. The amount shipped must have run into many thousands but no one can tell just how many. My guess would be about 100,000 or more. No birds were returned to California as they had no value here."

Although this information is admittedly unverifiable, there is no reason to doubt its general theme—that many thousands of House Finches were shipped to many eastern states from California by many shippers during a period of years, which practice may still be carried on to a minor degree. And circumstantial evidence, at least, indicates that the surplus unsalable birds were released, perhaps by a single New York bird dealer, when the ban was effected in 1940.

There is no evidence that the Long Island population is the result of a *Carpodacus-Serinus* cross, but canary breeders consulted were unanimous in agreeing that it is possible, and point to a long list of successful hybridization with *Serinus* and other fringillid genera.

However, with all the evidence suggesting a California origin, it is noteworthy that the House Finches of Long Island appear, to all observers who have studied the bird in the field and then compared their impressions with museum specimens, to be extremely dark, dusky, and "smokier" than the average in California populations—indeed—than almost every other race of the species. This obvious duskiness proved baffling at first, and because the birds most closely resembled the populations of *Carpodacus mexicanus smithi* from Colorado and New Mexico, an entirely different explanation of their appearance on Long Island was sought. The possibility that the Long Island birds might be "sooted" was considered improbable, since the areas frequented by the House Finches on Long Island are suburban, close to the sea, non-industrial, and relatively clean. To date there has been little evidence of sooting in this area among other species with comparable habits.

Subsequent examinations of freshly collected specimens from Long Island, however, prove conclusively that these birds are heavily

sooted. In New York, Dean Amadon compared newly-collected, washed House Finches with earlier, unwashed specimens from Long Island, and found that the darker color of Long Island birds was attributable to dirt-stained plumage. In California, Alden H. Miller compared two specimens from Long Island with a large series in the collection of the Museum of Vertebrate Zoology. He reported that he could match them perfectly with individuals taken in the spring in the San Joaquin Valley of California and in the Los Angeles area. At this time of year the House Finches from these California areas show a great degree of individual variation in the degree to which the browns and reds have faded and brightened, respectively. Most of the birds from these areas were lighter and brighter than the Long Island birds, but apparently some individuals, depending on local conditions of exposure, remain much darker than others. From these same areas were found birds that were so dirty that they were actually darker in appearance than the two washed Long Island birds. Miller also compared the Long Island birds with *smithi* from the Denver district, and concluded that even when sooted, *smithi* shows broader stripings in both male and female than California birds. His conclusion, which the authors accept, is that the Long Island birds are without doubt *C. m. frontalis*, from California.

HABITAT AND BEHAVIOR ON LONG ISLAND

In its native West, the House Finch is found in a wide variety of environments. Dawson (Birds of Calif., 1: 214, 1923) speaks of its adaptability as being marvelous, and its success in its new eastern locale is perhaps further proof. According to Grinnell and Miller (Pacific Coast Avif., no. 27: 454, 1944) the habitat in California is remarkably varied, with a great diversity of situations meeting the four apparent requirements of: 1) water within a fairly wide cruising radius; 2) open ground affording growths of low seed-producing plants; 3) fruits and berries during part of the year, these may also substitute for nearby water; 4) places for roosting and nesting above ground level. At all its eastern sites, these requirements are amply met. On Long Island, east of the Lawrence-Hewlett areas, the species resorts principally to ornamental shrub and tree plantations in and around nursery grounds. In the Lawrence-Hewlett area, it is found chiefly associated with cultured evergreens on old estates.

In the West, the House Finch often nests in outbuildings and around the eaves and porches of houses, on cliffs, in shrubs, trees, hedges, or cactus of any size or height. Thus far on Long Island, the House Finch has confined its nesting to hedges and to coniferous trees of

various heights. The first nest discovered on Long Island was well-concealed near the center of the foliage of a 30-inch Austrian pine, about 12 inches from the top; this was the above-mentioned Babylon nest. Other nests in Hewlett and Westbury have been placed in ornamental spruces at heights up to 30 feet. Another nest in Babylon was found in a hedge about five feet from the ground.

As in the West, the Long Island birds build their nests of whatever materials may be locally available. The Babylon nest, found in the Austrian pine, was constructed of coarse grasses which made the exterior bulky. The interior was lined with finer grasses and contained little or no thread, floss, down, or string, material often noted in western nests. A nest in Hewlett was woven of slender twigs and rootlets with a lining of fine grasses and spruce needles.

FOOD

In the East, the House Finch has not thus far been reported in any of the destructive feeding practices often condemned in California. Its primary items of diet are weed and grass seeds, and the seeds of *Cerastrum* (mouse-ear chickweed), but it has also been seen feeding on the fruits and berries of some flowering shrubs. In winter, besides eating the fruit of nursery shrubs, it feeds on *Rhus* (sumac) berries to some extent. During the coldest months, the birds gather in flocks, and especially in the Lawrence-Hewlett area, depend on food set out at feeding stations. Here they often remain until late spring (May) when food becomes otherwise available to them. At Babylon and Westbury feeding stations are not as numerous; this is perhaps the reason for the disappearance of the birds in the winter of 1947–48 in the Babylon area and the increase in numbers farther west.

At the feeding stations the preference is for sunflower seeds (the bait which the California trappers cited as most successful); but in the absence of this seed, hemp, millet, rape, and cracked corn are readily consumed.

PRESENT STATUS

The House Finch on Long Island is non-migratory, although given to local wandering in winter to procure food. During frequent visits birds were found consistently in the Babylon area from 1942 through 1946, even in winter, although there was a noticeable increase in individuals concentrated here prior to the nesting season of 1946. In the Lawrence-Hewlett area the birds seem to gather in the winter into cohesive flocks, although there is considerable trading back and forth between nearby feeding stations, and almost daily variation in the number of visitors at the numerous feeding stations in the area.

The future prospects of the species in this region seem favorable. All four original groups are thriving and increasing in numbers, although more slowly than in the first few years. The increasing number of observations from outlying locations is further evidence of a growing population. The present (1951) population is estimated roughly at 280 individuals, as follows: Babylon, 70; Westbury, 35; Lawrence, 30; Hewlett, 90; scattered, 25; Connecticut, 30.

Ecologically there appears to be little or no conflict with other species. Thus far, its breeding grounds are not contiguous with those of the Purple Finch, *Carpodacus purpureus*, and since the Purple Finch does not normally remain throughout the winter, there is no competition for food at this season. It is not yet a competitor of the House Sparrow, *Passer domesticus*, except at the feeding trays, where, if anything, the House Finch is dominant and aggressive. Thus far there is no competition for breeding territory.

It may be that the species is entirely dependent on man's largess for its winter survival, but this in itself, while it might be a limiting factor, is no danger, since the feeding station is an increasing phenomenon in the region. The birds have survived several heavy snowstorms, but thus far have not been tested by any winter of prolonged severity. From the evidence, it would appear that this adaptable and colorful bird is a securely established resident of the Eastern United States.

SUMMARY AND CONCLUSIONS

The House Finch, *Carpodacus mexicanus*, is now a resident species in the Eastern United States, with an estimated population (1951) of 280 individuals, located almost entirely in southern Nassau County, Long Island, New York, and in Greenwich Township, Connecticut.

The first published record was for April 11, 1941, and the first collected specimen was taken January 17, 1948. The first nest was found in May, 1943.

The origin of the House Finch in the East appears to be in the release of caged birds by bird dealers following a ban on their sale commercially, enforced early in 1940. These caged birds had been trapped in California and shipped east in quantities during the preceding ten years.

The Long Island birds appear in the field to be extremely dark and dusky; but this appearance is caused by sooting, and washed specimens are identical with specimens of *Carpodacus m. frontalis* from California.

The habitat, behavior, and prospects for the species in the East are discussed.

Linnaean Society of New York, New York, New York, February 8, 1952.

OBSERVATIONS AND NEW RECORDS OF BIRDS FROM THE BIMINIS, NORTHWESTERN BAHAMAS

BY CHARLES VAURIE

DURING the summer of 1951, Mrs. Vaurie and I were sent to Bimini by the American Museum of Natural History to make a general collection of the insects and spiders found in the Bimini Island Group. We arrived on June 8 and left on August 24, and collected on virtually every day, by day and night, visiting all possible habitats. Since these islands are little known ornithologically I took this opportunity to keep daily records. The birds observed by us and the records of some additional species furnished to me by Dr. C. M. Breder, Jr., have added 35 new species to the list of the birds of Bimini. A few notes on the general behavior and ecology of some species were made.

We wish to express our appreciation to Dr. M. A. Cazier, chairman of the Department of Insects and Spiders, for sending us to Bimini where we were the guests of the Lerner Marine Laboratory of the Department of Fishes and Aquatic Biology of the American Museum of Natural History; to Dr. Breder, director of the laboratory, and to his staff; and to Mr. and Mrs. Michael Lerner. I am personally indebted to Dr. Breder, who is interested in ornithology, for permitting me to use his records and those of Mrs. Hickman of Bimini. Dr. D. Amadon and Mr. J. Bond have read the manuscript, and I thank them for their comments and suggestions.

The geographical features of the Biminis are given in a recent paper by Howard (Ecol. Monog., 20: 317–349, 1950). This paper contains an excellent treatment of the vegetation, and of the structure and use of the land. It is well illustrated by a good map and 26 photographs showing almost all the types of habitat, and these figures are referred to below.

The Bimini Island Group is the westernmost of the northern Bahamas and lies on the eastern side of the Gulf Stream on the very edge of the Great Bahama Bank, approximately 60 air miles east of Miami. The islands, which structurally are a part of the Bank, are very low, the highest point of land being about 30 feet, and are arranged in the form of a triangle made up of the three major islands of South, North, and East Bimini. The triangle is about four miles wide by six high.

The base, which faces south, consists of the island of South Bimini. This island, the richest faunistically by far, is the widest, being about one and three quarters of a mile wide at the western end. There is

hardly any soil in the Biminis, with the exception of some parts of South Bimini, which are fertile and maintain a low but very dense woody vegetation which, together with marginal areas provide habitat for several bird species not found elsewhere in the Group. A large part of South Bimini is taken up by an irregular salt-water bay. This bay, now known as Cavelle Pond, was until recent years a fresh-water lake called Duck Pond on earlier maps and reported to be the stopping place of many migratory fowl. Through misguided zeal this lake was connected to the sea and now the natives state that the ducks no longer stop there.

North Bimini forms the western side of the triangle and its apex. It is very long and very narrow, most of it being but a rocky ridge which, except in one or two places, is between 400 and 500 feet wide. The entire human population of the Biminis lives on the southern half of this island. North of the settlement extends a landscaped area consisting of a plantation of Australian pine, *Casurina equisetifolia*, which has few birds. The northern half of the island consists of flat sandy beaches and low shrubs and is fringed by mangroves on the bay side. This part of the island is very low and is often breached by heavy seas. Only the commonest land birds occur on North Bimini.

East Bimini forms the upper half of the eastern side of the triangle, the lower half being open onto the Bank. This island is narrow and solidly covered by red mangrove on the bay side, the eastern shore consisting of long sandy beaches.

The remaining islands are within the triangle and are small; they are merely patches of red mangrove or are almost entirely covered with it. Judging by the amount of calling heard, these islands, and other mangroves throughout the Group, are the home of many *Rallus longirostris*. We did not land and the only species observed flying among these small islands were occasional Gray Kingbirds (*Tyrannus dominicensis*) and White-crowned Pigeons (*Columba leucocephala*). It is interesting to note that one of these islands is called Pigeon Key and was once, it is said, the home of a large colony of *C. leucocephala*.

The bay between the islands is very shallow and at low tide some areas are completely exposed, these flats becoming then the feeding ground of gulls, herons, and shore birds. At present there is no standing fresh-water anywhere in the Group. We know of four ponds, all small and all more or less brackish, one of which is situated at the southern end of South Bimini and attracts a good variety of passing birds. The small fresh-water pond shown on Howard's Figure 24 (*op. cit.*) is now strongly brackish and the stand of cat-tail, *Typha*, the only one in the Group, is dead.

From the tip of South Bimini a chain of rocky islets extends along the edge of the Bank. The two largest, Turtle and Piquet Rocks, respectively about four and five miles from South Bimini, are the home of colonies of terns (*Sterna anaethetus*, *S. fuscata*, and *Anoüs stolidus*). These two islets, which are about 350 feet long by 100 at their widest and about 20 feet high, are very badly eroded and are bare of vegetation except at the top where there are patches of some low red succulent plant. They were visited twice.

Gun Key at the end of the chain and about nine miles from South Bimini was visited once. Although fairly large, about one and one half miles long, this island is narrow and its arborescent vegetation very scanty. The only land birds found were a pair of *Tyrannus dominicensis* which on June 15 had a nest in a clump of low and dying trees, the only trees on the island other than half a dozen palms.

Distribution and Density of Bird Populations

In the Biminis, land birds are not evenly distributed and are relatively uncommon. Of the 12 species, breeding or probably breeding in the Group, only the three commonest, apparently, breed on the southern half of North Bimini. These, in order of abundance, are: *Columbigallina passerina*, 10 or more pairs; *Tyrannus dominicensis*, six pairs; *Mimus polyglottos*, four pairs. This part of the island is very much disturbed by the relatively dense population of 1100 people, and nothing remains of the original vegetation with the possible exception of a few shrubs. On the northern half of this island another species, *Chordeiles minor*, occurs (at least one breeding pair), but *T. dominicensis* and *M. polyglottos* are apparently absent. This part of the island is uninhabited but, as stated, is mostly sand with low strand and coastal rock plant communities.

On South Bimini all 12 species breed, and it is possible that *Zenaida aurita* or *Z. macroura* may breed there also. This island, the largest single land mass in the Group, presents the greatest variety of habitat and is moreover uninhabited and relatively undisturbed except for a few desultory efforts at cultivation. On the western end of this island, which we covered minutely on almost every week-day, the following species had nests or established territories in an area about 1.5 miles wide by 2.5 long: *Columba leucocephala*, three pairs; *Columbigallina passerina*, 30 or more paired individuals wandering through the area; *Coccyzus minor*, one pair; *Chordeiles minor*, six or more individuals flushed or flying; *Calliphlox evelynae*, two pairs; *T. dominicensis*, four pairs; *M. polyglottos*, two pairs; *Vireo crassirostris*, five pairs; *V. altiloquus*, three pairs; *Tiaris bicolor*, five pairs; and *Loxigilla violacea*,

two or three pairs. This represents, of course, only a part of the population of South Bimini, but the area sampled is the richest and most varied. The only breeding species apparently lacking in this area was *Coereba flaveola* although, as far as we could tell, the area was well suited for it. The only species which appears to be relatively commoner on North than on South Bimini is *M. polyglottos*.

East Bimini was not visited often enough to survey its bird life, and then only at its northern tip, but as already stated, the available habitats are very limited. At least one species, *C. leucocephala*, breeds in the whiteland plant communities (see Howard, *op. cit.*) at the center of some keys. Inaccessibility seems to be a determining factor in the nesting of this species.

TERN COLONIES

The tern colony on Turtle and Piquet Rocks consists of a little over 200 individuals divided about as follows: 115–120 *Anoüs stolidus*, 75–80 *Sterna anaethetus*, and 10–15 *S. fuscata*. We visited the colony twice. On June 15 all three species were incubating. On July 12 only *Anoüs stolidus* was incubating, of which we found 20 individuals sitting on their eggs. Other unattended eggs were about but we could not identify them. None of the three species used nesting material although the single egg sometimes rested among a few bits of shell and stone. We could see no clear-cut preferences in nesting sites; the egg was either hidden in a rock crevice or laid in the open, but more *Anoüs stolidus*, perhaps because they were more numerous, had chosen the latter.

This colony is not successful as it is constantly raided by the natives who, although they can distinguish the Noddy by name, call all three species "egg birds." It is conveniently situated, unfortunately, on the edge of the richest conch bed which is visited daily, weather permitting. As conch is the chief food staple of the islands, eggs provide a very welcome addition. Equally welcome are the chicks, if any egg is overlooked and succeeds in hatching. The boatman who landed us on July 12 requested us to bring him half a dozen, but we found only one Noddy chick after three hours of searching. Nevertheless, the birds have come back every year, the only possible explanation, I think, being that they represent an overflow from some isolated and successful colonies. When we left on August 24 we passed quite close to the colony which seemed deserted except for two or three Noddies.

Another tern colony consisting of about a dozen pairs of *Sterna albifrons* is located on a small sandy and rocky point at the southwestern end of South Bimini. This small colony apparently is not disturbed and the birds had young on August 10. This species probably breeds also, in small numbers, on Gun Key.

ECOLOGY

A few ecological observations may be briefly mentioned. As stated, *Columba leucocephala*, probably because of persecution, is found only in the wilder areas or in those with the densest vegetation. *Columbigallina passerina*, although seen daily in good numbers, was almost never seen on the beaches proper; once a single individual was observed feeding below the high water mark on drifted sargasso weed. *Tyrannus dominicensis* occurs almost everywhere except in the dense underbrush or tangled scrub where conspicuous perches are lacking. It is the only species breeding on desolate Gun Key and the only one found to nest in the Australian pines. As the summer wears on, an important item in its food, perhaps the bulk of it, is cicadas caught on the wing. *Mimus polyglottos*, although nesting elsewhere in marginal areas, is definitely commoner near houses. *Calliphlox evelynae*, *Tiaris bicolor*, and *Loxigilla violacea* nested on the margins of the scrub, the last preferring trees or tall bushes, and *T. bicolor* the thicker bushes in more open areas. *Coereba flaveola* was observed only when feeding on the spectacular scarlet orange blooms of *Cordia Sebestana*.

But the most interesting ecological situation is presented by the two species of land birds which are most closely related, *Vireo crassirostris* and *V. altiloquus*. The first, a somewhat smaller bird, ranges widely wherever dense scrub or thickets occur, but it breeds also in good numbers in the same habitat as *V. altiloquus*. This latter was found only in the thickly-wooded part of the ridge on the western end of South Bimini. In this area the trees, consisting largely of second growth, are small, and in places grow so closely as to form impenetrable thickets, but there are also a few large trees mostly of the families Ficaceae and Sapotaceae. It is only in these larger and taller trees (none over 25 feet high) that *V. altiloquus* breeds, feeds, and sings, while *V. crassirostris* is found directly below in the thickets and dense undergrowth. We never saw *V. altiloquus* close to the ground or *V. crassirostris* in the top of the trees. Competition for food and nesting sites is thus avoided.

BEHAVIOR AND PREDATION

These observations concern only a few instances of interspecific relationships, such as aggressiveness, tameness, and predation. As is well known, *T. dominicensis* is a very aggressive species; and on North Bimini, because the land is so narrow, it constantly sallies out over the sea and bay, sometimes for considerable distances, in pursuit of large species such as *Fregata magnificens*, *Larus atricilla*, the large herons, and Brown Pelicans. It was not unusual to see a Frigate-bird attacked simultaneously by as many as three Kingbirds and suffer ap-

parently direct blows to the head and upper back. The attackers would then often turn on each other after the large bird finally escaped. The Frigate-birds made no effort to defend themselves against the small Kingbirds but occasionally pursued and attacked the large *Thalasseus maximus*. Another species attacked by *T. dominicensis* is *Ceryle alcyon*, and in some localities *M. polyglottos*. On South Bimini the latter and *T. dominicensis* loudly and vigorously defended their respective territories against each other, but on North Bimini some *modus vivendi* had apparently been reached, for they ignored each other even when flying or feeding in the same territory. In the Biminis smaller birds are not molested by either species. Both defend their territories most aggressively against members of their own species.

An incubating *M. polyglottos* drove off all intruders, even cats, dogs, and humans, but just the same its nest was robbed by some unknown predator. *Larus atricilla* was not aggressive except when feeding on the flats, when it would invariably chase off any *Butorides virescens* in sight as well as any shore birds such as *Arenaria interpres*, the gull emitting a peculiar croaking note all the while.

These were the only instances of aggressiveness noted and in contrast we were often charmed by the confiding nature of some species. We seldom could appear on the territory of *V. crassirostris* without being closely followed, sometimes at arm's length, the bird often singing *sotto voce* all the while. All our movements were scrutinized, and the swing of our insect nets with which we could have easily caught the bird was quickly recognized as harmless. *Tiaris bicolor* was equally tame, and on one occasion one perched briefly on my shoulder. These two species, it is true, were found only on uninhabited South Bimini, but another species, *C. passerina*, is almost as tame in the settled part of North Bimini as it is on South Bimini. Of course, the Ground Dove is always gentle. This dove apparently drinks freely, for on the last-named island it regularly fluttered in and out of a well four feet wide by seven or eight deep, and into another, equally deep but only a foot and a half wide. Dr. Breder has also related to us the extraordinary tameness of some wintering warblers such as *Dendroica palmarum* which take up residence in houses.

The natives do not molest the small birds, but all the large birds, with the exception of *L. atricilla* which enjoys sentimental protection, are considered good food. Human predation not only blights the tern colony but has probably reduced the population of herons and has reduced to a very low point the population of *C. leucocephala* which is said to have been very large.

On land the chief predator, in addition to man, would seem to be snakes which are abundant throughout the Group outside of the

settled areas. We saw several species of large and small boas, all very active at night in trees and bushes. This factor is made more serious because there are apparently very few small mammals (a marsh rabbit is reported but the only mammal seen was a mouse), and there is but one species of frog, moderately abundant. Lizards, which however are rather small, are abundant and may destroy the eggs of the smaller birds. Another possible predator is the land crab which is innumerable, omnivorous, and a good climber.

Finally a factor, hard to assess but which on occasion completely destroys certain habitats, is the prevalence of severe storms. In recent years the Biminis have been swept by several hurricanes and numerous minor storms.

List of the Birds of the Biminis

Forty-four species have been recorded from the Biminis and, as stated in the introduction, our observations and those of Dr. Breder have added another 35, making a total list of 79 species. In the list below these new records are indicated by an asterisk (*). Forty of the previously recorded species were included in the general lists of the birds of the Bahamas by Cory ("Catalogue of West Indian Birds," 1892) and by Riley ("The Bahama Islands," Macmillan, New York, pp. 358–368, 1905). The other four were recorded by Friedmann Auk, 65: 142, 1948), and Bond ("Check-list of the Birds of the West Indies," 1950).

All the species recorded from the Biminis are listed below. As well over 50 of these species are migrants from North America or visitants from North America or the larger Bahamas, these are merely listed with, in the case of the species observed, the first date on which they were seen if migrants, or the actual date if seen but once or twice. In the case of some of the species that were not seen, relevant information including new records is given if available in the literature or supplied by Dr. Breder or the natives. A number of species which showed no evidence of breeding were present regularly or fairly often but at irregular intervals thoughout our stay. These non-breeding species, some of which have been discussed recently by Eisenmann (Wilson Bull., 63: 181–185, 1941) are indicated by (S) and the minimum and maximum numbers of individuals seen on any occasion are given. Breeding species are indicated by (B) and are discussed briefly in the list or preceding text.

The order followed and the nomenclature are those of Bond's check-list and the terms of relative abundance are used in the same manner. The vernacular names used are those given by Bond in his 'Field guide to birds of the West Indies' (Macmillan, New York, 1947).

Pelecanus erythrorhynchos, AMERICAN WHITE PELICAN.

(S) *Pelecanus occidentalis*, BROWN PELICAN.—One to two individuals throughout our stay.

(S?) *Phalacrocorax auritus*, DOUBLE-CRESTED CORMORANT.—Seven to eight large cormorants, probably this species, on June 16, 19, and July 12.

(S) *Fregata magnificens*, AMERICAN FRIGATE BIRD.—Two to eight individuals throughout our stay.

(S) *Ardea herodias*, GREAT BLUE HERON.—One individual at irregular intervals. The local name is "Gaulin," but it is also called "Arsnicker" as are all other herons with the exception of the Little Green Heron.

(*S) *Casmerodius albus*, YELLOW-BILLED EGRET or AMERICAN EGRET.—One to two individuals at irregular intervals.

(*) *Hydranassa tricolor*, LOUISIANA HERON.—One individual, June 22.

(*) *Florida caerulea*, LITTLE BLUE HERON.—One individual in white plumage washed with gray on June 20.

(B) *Butorides virescens*, GREEN HERON.—Common and breeding in the red mangrove throughout the Group. The local name is "Poor Joe" because, so it is said, there is so little to eat on it.

(B) *Nyctanassa violacea*, YELLOW-CROWNED NIGHT HERON.—Common; immatures but not adults were usually very tame.

Ajaia ajaja, ROSEATE SPOONBILL.

(*) *Phoenicopterus ruber*, ROSEATE FLAMINGO.—Reported by the natives in the "1920's," and three individuals in the spring of 1948 or 1949 by Dr. Breder.

(*S) *Falco sparverius*, AMERICAN KESTREL.—According to Dr. Breder's notes this species occurs "all year" on North Bimini but is commoner in winter. One individual was seen on South Bimini on July 2.

(B) *Rallus longirostris*, CLAPPER RAIL.—Common and breeding in the red mangrove throughout the Group. Very vocal up to the end of June, a few starting to call again about August 14. They often called at night, even on cloudy, moonless nights. The local name is "Mud Hen."

Charadrius hiaticula, NORTHERN RING-NECKED PLOVER or SEMIPALMATED PLOVER.—First seen on July 22.

(*) *Charadrius melodus*, PIPING PLOVER.—First seen on August 6.

Charadrius wilsonia, WILSON'S PLOVER.—First seen on July 22. Apparently only a migrant in the Biminis.

Charadrius vociferus, KILLDEER.—A flock of 20 reported by Dr. Breder between October 30 and December 9, 1949.

(*S) *Squatarola squatarola*, BLACK-BELLIED PLOVER.—Three to eight individuals not in breeding plumage present throughout our stay.

(*) *Himantopus himantopus*, STILT.—One individual on June 24–27.

(*S) *Arenaria interpres*, TURNSTONE.—Ten to 15 individuals, not in breeding plumage, were present throughout our stay.

(*) *Tringa melanoleuca*, GREATER YELLOW-LEGS.—One individual on July 9 and 13.

(*) *Tringa flavipes*, LESSER YELLOW-LEGS.—Two individuals on July 2.

(*) *Tringa solitaria*, SOLITARY SANDPIPER.—One individual on August 13 in company with the following species of sandpiper.

Actitis macularia, SPOTTED SANDPIPER.—First seen on July 22.

(*) *Calidris fuscicollis*, WHITE-RUMPED SANDPIPER.—Six individuals on August 17.

(*S) *Larus atricilla*, LAUGHING GULL.—Twenty or more individuals present throughout our stay but no evidence of breeding. However, on August 5 and for several days afterwards we saw adults feeding begging immatures, the latter being present from then on.

(*) *Gelochelidon anglica*, GULL-BILLED TERN.—Seen but once (at very close range) on July 8 in company with *Thalasseus sandvicensis*, the difference in the size of the bill being conspicuous.

(*) *Sterna hirundo*, COMMON TERN.—First seen on August 5.

(*S) *Sterna dougallii*, ROSEATE TERN.—Two to five individuals throughout our stay.

(*B) *Sterna anaethetus*, BRIDLED TERN.—Common.

(*B) *Sterna fuscata*, SOOTY TERN.—Common.

(*B) *Sterna albifrons*, LEAST TERN.—Common.

(S) *Thalasseus maximus*, ROYAL TERN.—Two to five individuals seen every day, except on August 7 when 16 individuals, some of them apparently immature, appeared.

(*S) *Thalasseus sandvicensis*, SANDWICH TERN.—Three to 25 individuals throughout our stay.

(*) *Chlidonias niger*, BLACK TERN.—One individual in piebald plumage on August 5.

(*B) *Anoüs stolidus*, COMMON NODDY.—Common.

Rynchops nigra, BLACK SKIMMER.

(B) *Columba leucocephala*, WHITE-CROWNED PIGEON.—Fairly common. The local name is "Wild Pigeon."

(*) *Zenaida macroura*, MOURNING DOVE.—Seen but once, a pair, on July 20.

(*) *Zenaida aurita*, ZENAIDA DOVE.—Seen "all year," according to Dr. Breder but not seen by us. Notes of either this species or the preceding one were heard by us occasionally on South Bimini, and the natives refer by name to a breeding "Wood Dove." According to Bond (personal communication) there is evidence that this species and the preceding one wander about in the Bahamas.

(B) *Columbigallina passerina*, GROUND DOVE.—The commonest land species in the Biminis. The local name is "Tobacco Dove."

(*B) *Coccyzus minor*, MANGROVE CUCKOO.—Probably breeding, as two birds always called from the same spot in the red mangroves near Cavelle Pond but were never seen. Occurs also at the eastern end of South Bimini and probably elsewhere.

Crotophaga ani, SMOOTH-BILLED ANI.—This species may not be established in the Biminis. It was not seen by us and during the past four years has been observed but once by Dr. Breder—one individual on March 25, 1949.

(*) *Speotyto cunicularia*, BURROWING OWL.—Dr. Breder reports that on his return to Bimini on October 16, 1951, he found that one very tame individual had taken up residence on the laboratory grounds.

(*B) *Chordeiles minor*, NIGHTHAWK.—Common. The notes are '*Kayrrĕkĕtĕ*' as in the populations of *gundlachii* observed in Cuba, not the nasal '*peent*' of nominate *minor* from North America.

(B) *Calliphlox evelynae*, BAHAMAN WOODSTAR.—Fairly common.

Ceryle alcyon, BELTED KINGFISHER.—First seen on July 17.

Sphyrapicus varius, YELLOW-BILLED SAPSUCKER.—Said to be a common winter resident. We saw much evidence of the characteristic markings; the trees most often selected are Australian pines and, strange to say, coconuts.

(B) *Tyrannus dominicensis*, GRAY KINGBIRD.—The commonest species of land bird after *C. passerina*. Natives state that it is a summer visitor only. The local name is "Pipiri."

(*) *Callichelidon cyaneoviridis*, BAHAMAN SWALLOW.—First seen on August 14 and daily thereafter in company with the following species. According to Bond (personal communication) these individuals were probably transients from Grand Bahama or Abaco.

(*) *Hirundo rustica*, BARN SWALLOW.—First seen (1 adult) on August 3; immatures appeared a week later. Abundant in November, according to Dr. Breder.

(B) *Mimus polyglottos*, NORTHERN MOCKINGBIRD.—Common.

Dumetella carolinensis, CATBIRD.—Said to be a common winter resident.

(*) *Turdus migratorius*, AMERICAN ROBIN.—One individual reported by Dr. Breder on the laboratory grounds between October 30 and December 9, 1949.

Polioptila caerulea, BLUE-GRAY GNATCATCHER.—First seen on August 16. Very tame.

(B) *Vireo crassirostris*, THICK-BILLED VIREO.—Common. Although Bond states (Birds of the West Indies, p. 302, 1936) that the iris is grayish in the adult of this species, all the individuals seen by us, adult as well as juvenile, had a blackish or very dark brown iris. In the geographical representative, *V. griseus*, the iris is whitish. *V. crassirostris* sang much later into August than did *altiloquus*. The song and call notes are quite variable and not easy to describe; some scolding notes are similar to the "mewing" note of *Dumetella carolinensis*. At close range the heavy bill is conspicuous, and the legs and feet are bluish gray. The yellowish eye-ring, lores, and frontal band, and the yellowish wash of the underparts are more strongly defined in the adult than in the young.

(B) *Vireo altiloquus*, BLACK-WHISKERED VIREO.—Common. Probably has more than one brood, for on August 20 a pair was seen feeding young not long out of the nest.

(B) *Coereba flaveola*, BANANAQUIT.—Observed only twice, on July 17 and 31, at the eastern end of South Bimini where it probably breeds. Although we found this species to be rare, our observations probably do not reflect its true status as it is well known to the natives under the name of "Banana bird" and is said to be fairly common in winter. Dr. Breder reports it as being present "all year." Possibly the species is more retiring during and just after the breeding season, but this does not explain its absence from the western end of the island which would seem to be equally suitable for nesting.

Mniotilta varia, BLACK AND WHITE WARBLER.—First seen on August 16. All warblers, with the possible exception of this species and the Redstart, are called "Chip Chip" by the natives.

Limnothlypis swainsonii, SWAINSON'S WARBLER.

(*) *Helmitheros vermivorus*, WORM-EATING WARBLER.—First seen on August 18.

Parula americana, PARULA WARBLER.

Dendroica tigrina, CAPE MAY WARBLER.

(*) *Dendroica caerulescens*, BLACK-THROATED BLUE WARBLER.—Reported on May 4, 1947, by Mrs. Hickman.

Dendroica coronata, MYRTLE WARBLER.—Reported on November 20, 1949, by Dr. Breder.

Dendroica dominica, YELLOW-THROATED WARBLER.—First seen on August 16. All individuals seen had the underparts white from the lower breast down and the superciliary stripe appeared to be entirely white.

Dendroica discolor, PRAIRIE WARBLER.—First seen on August 14, and it was the commonest warbler thereafter.

Dendroica palmarum, PALM WARBLER.—Common winter resident according to Dr. Breder.

Seiurus aurocapillus, OVEN-BIRD.—Reported on May 4, 1947, by Mrs. Hickman.

Seiurus noveboracensis, NORTHERN WATER-THRUSH.—Reported on May 4, 1947, by Mrs. Hickman.

Seiurus motacilla, LOUISIANA WATER-THRUSH.—First seen on August 17, common thereafter, chiefly in the mangroves.

Geothlypis trichas, YELLOW-THROAT.—The head, wings, and upper parts of the body of one rather freshly dead specimen were found on June 9. Both sexes reported on May 4 by Mrs. Hickman and a large wave of this species on May 14 by Dr. Breder.

Setophaga ruticilla, AMERICAN REDSTART.—First seen on August 17 (females or immature males). Both sexes reported in 1947 on May 4 by Mrs. Hickman and a large wave on May 14 by Dr. Breder.

Agelaius phoeniceus, RED-WINGED BLACKBIRD.—According to the natives this species is seen only in the spring and in the fall when it is more abundant. According to Bond (personal communication) the Bahaman race (*bryanti*) "is known to nest among mangroves, where the bird might escape detection." However, despite a continuous search which included mangroves, we failed to find it. It may have bred formerly around Cavelle Pond, but now apparently it is only a migrant, or a wanderer from the larger Bahamas.

(*) *Dolichonyx oryzivorus*, BOBOLINK.—A dead and dried specimen was found on June 9. According to Mrs. Hickman "Bobolinks arrive a little before May 1 in large numbers, some dying, and all evidently exhausted."

(B) *Tiaris bicolor*, BLACK-FACED GRASSQUIT.—Common. The extent of the black markings of the males varies individually. The song is weak but insistent, two or three '*ticks*' followed by a short trilled '*zeeeeee*.'

(*B) *Loxigilla violacea*, GREATER ANTILLEAN BULLFINCH.—Fairly common. The note heard most often was very similar to the buzz of a cicada.

Ammodramus savannarum, GRASSHOPPER SPARROW.

American Museum of Natural History, New York, New York, November 1, 1951.

ON THE LOCOMOTOR ANATOMY OF THE BLUE COUA, *COUA CAERULEA*

BY ANDREW J. BERGER

THIS is the third in a series of papers on the anatomy of the Cuculidae. The anatomy of at least a third of the genera of cuckoos apparently has never been investigated. Of most of the remaining genera, data have been published on only a few anatomical characters. Beddard (1898: 280–281) and Pycraft (1903: 287) classified the cuckoos whose anatomy was known to them (less than half of the genera). Both authors used leg-muscle formulae and structure of the syrinx. Beddard also used certain features of the pterylosis, whereas Pycraft adopted osteological features in his system. The two systems resulted in considerable disagreement as to the placement and relationship of genera. Garrod and his successors determined the leg-muscle formula in all genera available to them; Beddard (*op. cit.*, p. 280) gave the formula of *Coua* as ABXYAm. Except for the following three papers, however, nothing has been published on the detailed anatomy of the lower extremity of cuckoos: Shufeldt, 1886, on *Geococcyx californianus;* Hudson, 1937, *Coccyzus americanus;* Berger, 1952, *Coccyzus erythropthalmus, Crotophaga sulcirostris,* and *Geococcyx californianus.* Garrod (1881: 360), Fürbringer (1888, Plate 23), Gadow (1891: 256), Beddard (*op. cit.*), and Lowe (1943) mentioned or illustrated the structure of the tendon of M. tensor patagii brevis in cuckoos, but the total wing myology has not heretofore been described. I recently described the pterylosis of *Coua caerulea* (Berger, 1953).

All attempts to classify the Cuculidae have been unsatisfactory, and I have found it impossible to classify them by compiling data supplied with the several systems proposed. It is obvious that reclassification can be accomplished only after the anatomy, behavior, and ecology of each genus have been studied. This paper is a contribution toward that end.

I am indebted to the following who have made this study possible: Dr. Jacques Berlioz, Muséum National d'Histoire Naturelle, Paris, and Dr. Dean Amadon and Mr. Charles E. O'Brien, American Museum of Natural History, who sent me alcoholic specimens of *Coua caerulea;* Mr. E. Banks, British Museum (Natural History), London, and Dr. Herbert Friedmann, United States National Museum, for the loan of skeletal material.

OSTEOLOGY

Milne-Edwards and Grandidier (1878) illustrated articulated skeletons of *Coua pyropyga* (= *C. cristata pyropyga*), *caerulea*, *gigas*, *ruficeps olivaceiceps*, and *coquereli*, as well as certain disarticulated bones of *C. serriana*, *caerulea*, *cristata*, *ruficeps olivaceiceps*, and *gigas*, and (1879) presented a series of measurements of bones of several species. Pycraft (1903) illustrated the skull, sternum, and shoulder girdle of *C. reynaudii*.

Even at the present time, one cannot attempt a thorough analysis of this genus because of the lack of material. In view of their obvious historical value, the specimens studied by Milne-Edwards cannot be obtained on loan. By writing to numerous museums, both in the United States and abroad, I have been able to secure four skeletons of the genus *Coua:* two complete skeletons of *caerulea*, and one body skeleton each of *cristata* and *reynaudii*. The following discussion, therefore, deals with this material. Measurements were made with dial-type calipers, accurate to one tenth of a millimeter.

Each of the three species has 14 cervical vertebrae, of which the last two possess cervicodorsal ribs. The last cervicodorsal rib bears an uncinate process. The atlas is perforated by the odontoid process (see Beddard, 1898: 117 and 280).

There are four free dorsal vertebrae, each of which bears a vertebral rib which articulates with the sternum by means of a sternal counterpart. Each of the first three dorsal ribs bears an uncinate process, but this structure is wanting on the last dorsal rib. I was unable to find any evidence of a thoracic rib either in *C. caerulea* or *C. reynaudii*. Whether this lack represents a species character or is due to inadequate material I cannot say. The fact is that one disarticulated thoracic rib was found with the skeleton of *C. cristata* and two facets for this rib are present on each side of the first fused vertebra of the synsacrum. This rib has both a vertebral and a sternal portion, but I am confident that the latter attached to the sternal portion of the last dorsal rib, rather than to the sternum directly. I found a similar condition in *Coccyzus americanus* and *C. erythropthalmus*. Pycraft (1903: 274) said of the Cuculidae: "The sternal segments of the fifth pair of thoracic ribs never reach the sternum. They may persist as vestiges, even the thoracic segment of the rib reaching the verge of disappearance, as in *Coua* [*reynaudii* and *caerulea?*] and *Rhamphococcyx*." Milne-Edwards and Grandidier (*op. cit.*) said that there are six ribs in the genus *Coua:* the anterior two are cervicodorsal ribs, the posterior four are true, or dorsal, ribs. They said nothing about the presence of thoracic ribs. Yet in their Plate 59, an articulated skeleton of *C.*

coquereli, they have illustrated *eight* ribs, of which the first three are cervicodorsal ribs. Although uncommon, such variation is to be expected in the number of these ribs. The eighth rib, mentioned above, might be a thoracic rib, but one cannot tell certainly from the illustration.

Pycraft further stated (*op. cit.*, p. 273): "The most complete synsacrum is that of *Coua*, and is made up as follows:—1 thoracic, 3 lumbar, 3 lumbo-sacral, 2 sacral, and 4 caudal, making 13 in all." By using intervertebral foramina and transverse processes, I have been able to count only 11 fused vertebrae in the synsacra of the two specimens of *C. caerulea* from the British Museum. One of these skeletons was studied by some earlier ornithologist, who marked in ink transverse lines on the synsacrum to indicate the approximate fusion planes of the vertebrae: the total number of fused vertebrae thus indicated is 13. I counted 13 fused vertebrae in the synsacra of *reynaudii* and *cristata*.

Three specimens of *caerulea* have, respectively, four, five, and six free caudal vertebrae, while a fourth specimen (alcoholic) has five with a sixth partially fused with the pygostyle. The free caudal series is not complete in the specimens of *cristata* and *reynaudii*. Pycraft (*loc. cit.*) said: "There are 6 or 7 post-synsacrals—free caudal vertebrae," in the Cuculidae. Milne-Edwards and Grandidier (1879: 170) reported that generally there are seven free caudal vertebrae in *Coua*, but recognized that there might be less than seven, due to fusion with the pygostyle. (See Berger, 1952: 520, regarding variation in number of free caudal vertebrae.)

TABLE I

Species	*Length of Sternum*	*Maximum Width of Sternum*	*Ratio*	*Length of Carina*	*Height of Sternum*[1]	*Ratio*	*Locomotor Habits*
reynaudii	27.5 mm	19.8	1: .72	26.3	8.7	1: .33	Terrestrial
cristata	35.3	31.0	1: .88	35.1	12.4	1: .35	Arboreal
caerulea[2]	32.9	29.7	1: .90	32.2	11.6	1: .36	Arboreal

[1] Overall height of sternum at anterior border of carina.
[2] Averages of two specimens.

The two pygostyles of *caerulea* measured in total height and width at the base, 17.0, 5.4, and 17.6, 5.7 mm., respectively. A disc is present, therefore, although relatively it is slightly less developed than in *Coccyzus erythropthalmus* or *C. americanus* (see Berger, 1952: 521).

The sternum is double-notched in each of the three species studied (see Fig. 2), although one alcoholic specimen of *caerulea* and the skeleton of *reynaudii* exhibit a partial obliteration by ossification of the notch between the external lateral and the internal lateral xiphoid processes. There is considerable difference in development of the

sternum, but this is not shown clearly in measurements of the carina itself. The best mensural indicators of overall sternal development seem to be total length of sternum and maximum width at the external lateral xiphoid processes.

The averages of measurements (in millimeters) of bones of two specimens of *C. caerulea* follow: length of dorsal region, 33.1; humerus, 44.5; ulna, 38.6; radius, 34.9; carpometacarpus, 18.9; digit II, 17.3; femur, 50.3; tibiotarsus, 85.4; tarsometatarsus, 55.2; hallux, 23.1; digit II, 31.7; digit III, 46.8; digit IV, 40.7; cranium (nasofrontal hinge to occiput), 35.4; interorbital width, 10.6; interparietal width (greatest), 26.8; length of synsacrum, 39.2; greatest width of pelvis (at posterior iliac crest), 35.1; width at pectineal processes, 26.3; width at anterior iliac processes, 23.0; length of pectineal process, 6.5; length of scapula, 38.3; length of coracoid, 26.8; length of furculum, 28.0.

The total length of the bony wing (119.3 mm.) is 50.2 per cent the length of the leg (237.7, including digit III). This ratio is less than that found in *Crotophaga sulcirostris* (59%) and approximately the same as that in *Geococcyx californianus* (49%) as given by Berger (1952: 526). If we exclude digit III from total leg-length, then the ratios of wing-length to leg-length in *Coccyzus erythropthalmus*, *Crotophaga sulcirostris*, *Coua caerulea*, and *Geococcyx californianus*, become, respectively, 93.9, 74.3, 62.5, and 59.8%.

From the above data, one might conclude that *Geococcyx californianus* and *Coua caerulea* must have nearly the same locomotor habits. Further analysis, however, reveals that a simple wing-length/leg-length ratio is inadequate for an understanding of the locomotor pattern in these two birds. Using length of the dorsal region as a standard, I computed ratios between this complex and the several elements composing the wing and leg. In order to make comparisons between *Coua* and other genera of cuckoos, I further computed the increase or decrease in length of limb elements of *Coua caerulea* by using the same elements of *Coccyzus erythropthalmus* as standard. Table II presents the results.

TABLE II

CHANGES IN LIMB ELEMENTS BASED ON COCCYZUS ERYTHROPTHALMUS

Element	*Crotophaga sulcirostris*	*Coua caerulea*	*Geococcyx californianus*
Humerus	− 6.1%	− 8.0	+ 1.3
Ulna	−17.1	−16.9	−10.0
Manus[1]	−12.9	−25.6	−17.6
Femur	+ 1.4	+ 9.9	+28.2
Tibiotarsus	+15.0	+33.5	+44.5
Tarsometatarsus	+14.6	+28.5	+58.4
Digit III	+ 2.4	+13.5	+16.0

[1] carpometacarpus plus digit II

Several points are obvious from these data. There is a progressive decrease in each element of the wing of *Coua* from those bones in *Coccyzus*, a migratory genus. The wing of *Coua* appears to show a greater decrease than does that of *Geococcyx*. Each element of the leg of *Coua* shows an increase over those elements in *Coccyzus*, but the increase is not progressive distad. One finds in general, then, a bird whose wing is considerably shortened from that of an arboreal migratory bird, and whose leg is considerably lengthened, even though the increase in the several segments does not follow what might be termed the "classical pattern" for concomitant changes in fore- and hind-limbs as correlated with locomotor habits. As a consequence, one might expect *Coua caerulea* to be a cursorial bird which uses its wings but little. It is, however, arboreal in habits. Sibree (1891: 218–219) reported that: "Five species of *Coua* [one of which is *caerulea*] inhabit the large forests, or at least the wooded regions, where they are found jumping from branch to branch in search of their food, which consists of insects, and especially of land-mollusks . . . . These five species are true climbers . . . . The climbing Couas go from tree to tree, cocking their tails, and making the solitudes of the forest resound with their short sharp cry."

Rand (1936: 223) also considered *Coua caerulea* "an arboreal bird of the humid forest," and (p. 401) stated: "The blue coua ranges through the forest from the tree tops through the middle spaces into the undergrowth, sometimes even running on the ground, and also ranges through the larger secondary brush." I wrote to Dr. Rand asking for further information on the way in which these birds move about through the trees. From his answer, I quote the following: "The three arboreal species *caerulea*, *cristata*, and *verreauxi* are geographical replacements. The terrestrial rain-forest species, *reynaudii* and *serriana*, have different food, one insects, one fallen fruit. In the dry forests and brush are four species, one rather wide-spread (*ruficeps*), but the other three are more restricted. *C. coquereli* and *cursor* are geographical representatives, and the much larger *C. gigas* co-exists with *C. coquereli* but overlaps the range of *C. cursor*.

"The group is, to my mind, a terrestrial type. The terrestrial species are at home, agile and graceful on the ground, swift on foot, and may prefer to escape danger on foot rather than flying or seeking concealment. The arboreal species, and this includes *C. caerulea*, have carried over as much of this as possible into their arboreal life. *C. caerulea* definitely does not climb about like a parrot.

"The various modifications in range, habitat, and habits seem to be the result of an intra-group pressure and competition with little

competition, in island isolation, from other groups. They have modified these without modification in structure.

"Thus, to use *Coua caerulea* as an example of an arboreal cuckoo is a mistake. It is a terrestrial-type that has taken to living in trees! Hence, its resemblance in leg-proportions to *Geococcyx* is what I would expect."

It is interesting to note in this connection that Milne-Edwards and Grandidier (1879: 170) commented on differences in development of the leg in various species of *Coua*. The following is a free translation of a portion of their comments: One does not perceive any relation between the habits of the birds and the dimensions of the tarsus; thus, the tarsi are long in *Coua caerulea*, which is arboreal, and in *Coua gigas* and *ruficeps*, which are terrestrial; they are, on the contrary, short in *Coua reynaudii* and in *Coua cursor*, whose habits are very different, the first being a climber and the second a runner.

The results obtained here point up sharply the difficulties and dangers involved in analysis of inadequate material and the necessity for considering ecological factors in the interpretation of anatomical data. It is unfortunate that it is not possible to present a thorough analysis of each species of the genus *Coua*, since it does contain both arboreal and terrestrial species. Before one can comment with much assurance on the significance of limb proportions, for example, between *Coua* and any other genus, he must know how much variation occurs within the genus *Coua* itself. This seems especially necessary because the relationship of *Coua* to other genera of cuckoos is at best imperfectly known.

Myology of the Appendages

Because the appendicular myology of the genus *Coua* has never been described, I have included certain details which should prove useful in further study directed to reveal adaptive changes in arboreal and terrestrial species within the genus and to reveal intergeneric relationships. Even though a living muscle continually changes in dimensions, the area of origin, of course, remains constant in a given specimen. The relative degree of development of a fleshy belly can be determined in alcoholic material and is useful in functional anatomical studies as well as for determining relationships. Features which, in a sense, may be more directly applicable to systematics are the presence or absence of a muscle or any peculiarity in its structure or relationship.

Terminology for wing muscles unless otherwise indicated follows Fisher (1946), who adopted names used by Howell (1937), Gadow

(1891), and Shufeldt (1890). For the sake of uniformity, I have used the same names for leg muscles as in my earlier paper (Berger, 1952). Osteological terminology follows Howard (1929). All dissection was done with the aid of a binocular microscope using ten times magnification.

A study of the nervous system of cuckoos has been started, but a report is premature. Consequently, I have said nothing about innervation. A thorough study of the innervation of wing muscles, for example, involves not only investigation of terminal nerve branches and the gross pattern of the brachial plexus, but also the localization within the central nervous system of the nerve cell bodies whose neuraxones form the brachial plexus and its terminal branches. Such an investigation, in turn, implies that one conduct neurone chromatolysis experiments. Although this type of anatomical study should be made, I do not believe that, for purposes of classification, the results to be obtained by this approach warrant, at present, the amount of labor involved.

DESCRIPTION OF WING MUSCLES

M. PECTORALIS SUPERFICIALIS (fig. 1)

This large single muscle covers Mm. supracoracoideus, coracobrachialis posterior, sternocoracoideus, and coracobrachialis anterior. It arises from the ventral one-third of the anterior two-thirds of the carina; the anterolateral and all of the posterior half of the body of the sternum; the internal lateral and external lateral xiphoid processes (Coues, 1903: 150) and the interxiphoid membranes; the costosternal membrane; and from the anterior and lateral aspects of the furculum and the adjacent surface of the coracoclavicular membrane throughout nearly their entire length. The belly extends dorsolaterad to the upper margin of the horizontal portion of the sternal ribs. It inserts on a triangular area on the palmar surface of the deltoid crest (pectoral crest, Shufeldt, 1890: 70). The insertion is mostly fleshy but it is surrounded by a dense fascial envelope. A fleshy fasciculus ("M. pectoralis, pars propatagialis" of Gadow) splits off from the superficial surface of the belly near its insertion. From this fasciculus, tendinous bands pass to the belly of M. tensor patagii brevis and to the tendon of M. tensor patagii longus.

M. SUPRACORACOIDEUS (fig. 2)

Laterally, the belly of this muscle is in contact with M. coracobrachialis posterior, and, superficially, both muscles are covered by M. pectoralis superficialis. M. supracoracoideus arises fleshy from about the dorsal two-thirds of the carina in its anterior two-thirds; from a triangular area on the anteromesial aspect of the body of the sternum adjacent to the carina; from the basal half of the anterior and medial surfaces of the coracoid; and from the basal two-thirds of the coracoclavicular membrane. There is no origin from the furculum. Fleshy fibers cover the tendon to within 3 mm. of the insertion. The tendon forms on the deep coracoidal aspect of the belly, and passes anterodorsolaterad through the triosseal canal to insert on the anterior edge of the humerus at the junction of the articular head and the deltoid crest. The tendon is concealed in a palmar view by M. coracobrachialis anterior.

M. CORACOBRACHIALIS POSTERIOR (fig. 2)

This muscle arises mostly fleshy from the sternocoracoidal process of the coracoid, from the lateral and posterior surfaces of the basal 12 mm. of the coracoid, and semitendinous from the anterolateral edge of the body of the sternum. It inserts by a short, stout tendon on the apex of the internal tuberosity of the humerus.

M. LATISSIMUS DORSI (figs. 3, 4)

This is the most superficial muscle complex on the dorsum and is, in reality, two muscles plus a dermal component.

1. *Pars anticus.* This anterior, thin, sheet-like portion arises by an aponeurosis attached to the neural spines of the last two cervical (13 and 14) and the first two dorsal vertebrae, though it attaches only to the anterior tip of the spine of dorsal vertebra 2. The area of origin is about 14 mm. long. The belly passes outward and forward, and between the scapulotriceps and humerotriceps, to insert on the anconal surface of the humerus, beginning about 12 mm. distal to the head, by a short (1 mm.), broad (5 mm.) tendinous band.

2. *Pars posticus,* likewise sheet-like in form, arises by an aponeurosis attached to the neural spines of dorsal vertebrae 2 and 3, and to the tendons of M. longissimus dorsi in the region of dorsal vertebra 4. The muscle is about 14 mm. in width at its origin. Just before entering the arm musculature, the belly passes deep to pars anticus and tapers to a flat tendon (6 mm. long and 1 mm. wide), which passes diagonally upward to its insertion on the humerus about 1 mm. proximal to the area of insertion of pars anticus.

3. *Dermal component.* This is a fleshy strap 7 mm. wide at its origin from the superficial surface of pars posticus in the region of dorsal vertebrae 2 and 3. The midportion of the belly is 2 mm. wide, but it broadens out to about 4 mm. at its insertion into the skin at the posterior margin of the humeral feather tract, slightly anteromesial to the insertion of the dermal component of M. serratus posterior.

M. RHOMBOIDEUS SUPERFICIALIS (figs. 3, 4)

The posterior portion of this muscle lies deep to M. latissimus dorsi, pars anticus, but the anterior part lies immediately deep to skin and superficial fascia. Posteriorly, the belly overlies the anterior half of the deeper M. rhomboideus profundus. The origin is by an aponeurosis from the neural spines of the last three (12, 13 and 14) cervical and the first two dorsal vertebrae, that from dorsal vertebra 2 being from the anterior tip of the spine only. The area of origin is about 25 mm. in length. It inserts by fleshy fibers on the dorsomesial surface of the scapula, beginning on the acromion process and extending caudad 26 mm.

M. RHOMBOIDEUS PROFUNDUS (fig. 4)

This muscle arises by an aponeurosis from the neural spines of the last two cervical, and by fleshy fibers from the first two dorsal vertebrae. The muscle is overlapped in its anterior half by M. rhomboideus superficialis. Whereas the fibers of M. rhomboideus superficialis pass forward and outward, those of profundus pass backward and outward to insert fleshy on the caudal 14 mm. of the dorsomedial surface of the scapula.

M. CORACOBRACHIALIS ANTERIOR (figs. 2, 4)

This fleshy muscle is 15 mm. in length and 2.5 mm. wide at its origin from the head of the coracoid, the coracohumeral ligament, and the tendon of origin of M. biceps brachii; it is 8 mm. wide at its insertion on the palmar surface of the humerus just proximal to the area of insertion of M. pectoralis superficialis. The belly covers

the anterior edge of the head of the humerus and the tendon of insertion of M. supracoracoideus. Posteriorly, the belly is overlapped by the tendon of origin of M. biceps brachii.

M. TENSOR PATAGII BREVIS (figs. 1, 3)

This is a strap-shaped fleshy muscle arising from the medial surface of the furculum and the acromion process of the scapula. The belly is about 25 mm. long and 7 mm. at its maximum width. It is inseparably fused with M. tensor patagii longus. Two tendons arise from the distal end of the fleshy belly. The one tendon represents that of M. tensor patagii longus, the other that of M. tensor patagii brevis. The latter is a narrow band about 2 mm. wide, which passes distad parallel to the humerus. Distally the tendon bifurcates. The short branch inserts into the heavy fascia covering the superficial surface of M. extensor metacarpi radialis. The long branch fuses with the antibrachial fascia, which extends the entire length of the forearm, covering the muscles and attaching to the bases of the greater secondary coverts. The strong tendinous band from the superficial fasciculus of M. pectoralis superficialis inserts into the belly of M. tensor patagii brevis just before the formation of its tendon.

M. TENSOR PATAGII LONGUS (figs. 1, 3).

One cannot separate the belly of this muscle from that of M. tensor patagii brevis. The fibro-elastic tendon (2 mm. wide proximally) of the longus passes distad in the anterior edge of the propatagium and becomes tendinous near the distal end of the forearm. A thin tendon arising from the superficial fasciculus of M. pectoralis superficialis joins the fibro-elastic portion of the tendon at its formation. There is a minor insertion on the extensor process of metacarpal I, but the tendon fans out to cover the pollex and to attach to the bases of the alula quills, and, on the palmar surface of the manus, it fuses with the deep fascia.

M. DELTOIDEUS MAJOR (figs. 1, 3)

This bulky muscle has two heads of origin. The larger head arises fleshy from the acromion process of the scapula for a distance of about 10 mm., and by a strong aponeurotic band from the antero-inferior edge of the acromion process. The smaller head arises from the os humeroscapulare, a small sesamoid encapsulated by the anconal portion of the capsule of the scapulohumeral joint. The two heads fuse almost immediately and insert fleshy on the anconal surface of the deltoid crest and the shaft of the humerus for a distance of 15 mm. distal to the crest, or for a total distance of 25 mm. Thus, there is a single, continuous, fleshy insertion.

M. DELTOIDEUS MINOR (fig. 4)

This fleshy muscle is about 10 mm. in length. It arises on the inside of the triosseal canal from the lateral surface of the furculum and from the inferior furcular process of the coracoid. The belly leaves the dorsal opening of the canal posterior in position to the tendon of M. supracoracoideus, and it inserts semitendinous on the antero-anconal surface of the humerus at the junction of the head and the deltoid crest.

M. PROSCAPULOHUMERALIS (figs. 3, 4)

This fleshy muscle is about 14 mm. in length. It arises from an area 4 mm. wide on the lateral aspect of the scapula immediately caudal to the posterior glenoid lip and the area of origin of M. scapulotriceps. It inserts fleshy on an area about 2 mm. long in the pneumatic fossa between the internal and external heads of M. humerotriceps.

M. SUBSCAPULARIS

The subscapularis has two heads which are separated by the anterior portion of the aponeurosis of insertion of M. serratus posterior. The external head arises from the lateral surface of the scapula for a distance of 7 mm., beginning about 5 mm. caudal to the posterior glenoid lip. It lies between the areas of origin of Mm. proscapulo-humeralis and dorsalis scapulae. The internal more extensive head arises from the medial surface of the scapula, beginning opposite the glenoid fossa and extending caudad for 18 mm. The two heads fuse and insert by a short stout tendon on the proximal surface of the internal humeral tuberosity near its base. The insertion does not extend into the capital groove.

M. DORSALIS SCAPULAE (fig. 4)

This strong muscle arises primarily by fleshy fibers from the lateral surface and by an aponeurosis from the ventral surface of the posterior 25 mm. of the scapula, posterior and dorsal to the origin of the lateral head of M. subscapularis. It overlaps all but the anterior 2 mm. of the latter muscle. M. dorsalis scapulae inserts by fleshy fibers, surrounded by a dense fascial envelope, on the anconal surface, proximal end, of the bicipital crest distal to the origin of the humeral tendon of M. biceps brachii and opposite the pneumatic foramen.

M. STERNOCORACOIDEUS (fig. 2)

This muscle arises mostly by fleshy fibers from the lateral surface of the sternocoracoidal process of the sternum and from the terminal 4 mm. of the sternal ribs at their costosternal articulation. It inserts mostly by fleshy fibers on the sternocoracoidal impression on the posterior surface near the base of the coracoid.

M. SUBCORACOIDEUS (fig. 2)

This muscle arises by two distinct heads. The smaller coracoidal head consists of a fleshy bundle about 12 mm. in length. It arises from the coracoclavicular membrane adjacent to the coracoid (but apparently not from that bone) 5 mm. superior to the base of that bone. The larger furcular head is triangular in shape, being widest at its origin over an area 10 mm. long on the medial surface of the furculum immediately inferior to the origin of M. tensor patagii brevis. The belly (about 12 mm. long) passes backward and outward to fuse with the coracoidal head about 5 mm. from the point of insertion. A single, short, stout tendon forms and inserts on the posterior surface of the internal humeral tuberosity proximal to the origin of M. biceps brachii.

M. SERRATUS POSTERIOR

This muscle consists of three main fasciculi plus a dermal component. The anterior slip arises from the last cervicodorsal rib ventral to its uncinate process. About 3 mm. inferior to the scapula, the fleshy fibers give way to a broad aponeurotic sheet which inserts on the ventral edge of the scapula beginning about 5 mm. caudal to the posterior glenoid lip and extending caudad to the fleshy insertion of the two posterior slips of the muscle. Anteriorly, this aponeurosis passes between the two heads of M. subscapularis. The two posterior slips arise, respectively, from the uncinate processes of the first and second true ribs. These two slips insert fleshy on the posterior 6 mm. of the apex of the scapula and by a thin aponeurosis which is continuous with that of the anterior slip. There is, thus, a continuous insertion on the ventral edge of the scapula on its posterior 29 mm.

The dermal component arises from the second true rib on a level with its uncinate process. It inserts into the skin at the posterior margin of the humeral feather

tract, slightly posterolateral to the insertion of the dermal component of M. latissimus dorsi.

M. SERRATUS ANTERIOR

This muscle arises by two fleshy fasciculi, one from the last cervicodorsal rib dorsal to the uncinate process, and the other from the upper half of the first cervicodorsal rib. The two fleshy slips insert together on the medial surface of the scapula immediately posterior to the area of insertion of M. serratus profundus.

M. SERRATUS PROFUNDUS

This muscle arises by fleshy fasciculi from the transverse processes of cervical vertebrae 11 and 12. It inserts on the medial aspect of the scapula for a distance of 20 mm., beginning slightly caudal to the middle of the bone.

M. BICEPS BRACHII (figs. 1, 2)

A roughly L-shaped tendon taking attachment from the coracoid and the humerus gives rise to this strong flexor. The stronger part of the tendon arises from the head of the coracoid immediately lateral to the triosseal canal and inferior to the origin of M. coracobrachialis anterior. The humeral attachment is by a broad (2 mm.) tendinous band from the posterior face of the base of the internal tuberosity. The length of the fleshy belly is about 32 mm. Two stout round tendons form about 6 mm. above the insertion areas, which are on the bicipital tubercles on the radius and ulna, located 2 mm. and 3 mm., respectively, distal to the proximal articular surfaces of those bones. A biceps slip to the tendon of M. tensor patagii longus is wanting.

M. TRICEPS (figs. 1, 2, 3, 4)

The triceps muscle has only two major parts, a scapulotriceps and a humerotriceps, though at the proximal end of the origin the latter may be separated into an internal and an external head. The scapulotriceps arises by a dense fascia on its deep surface and by fleshy fibers superficially from the posterior lip of the glenoid fossa. The internal head arises fleshy from the postero-anconal surface of the humerus beginning 5 mm. distal to the articular head and extending distad 30 mm. Its area of origin lies entirely posterior to the areas of insertion of the two parts of M. latissimus dorsi, but anterior to the insertion of M. proscapulohumeralis. The external head arises fleshy from the posterior surface of the bicipital crest and the shaft of the humerus to within 6 mm. of the distal end of the bone. Some fibers of the internal head insert on the tendon of the scapulotriceps, which passes through the internal tricipital groove to insert on the proximal end of the ulna anterior to the olecranon process. A strong tendon also forms on the deep surface of the external head and inserts on the olecranon process. Fleshy fibers of the internal head insert on this tendon.

M. EXPANSOR SECUNDARIORUM (fig. 1)

This muscle was described by Garrod (1876: 193–194) who considered it to be of value in classification. So far as I know, this muscle has been described by only one American worker: Burt (1930: 497 and Fig. 15) in *Ceophloeus* (= *Dryocopus*) *pileatus picinus*. Garrod's illustration of this muscle in *Gallinula chloropus* was re-drawn by Shufeldt (1887: 327; 1890: 110). Dr. George E. Hudson informs me (*in litt.*), however, that he has found M. expansor secundariorum to be present in all members of the Corvidae which he has examined. Garrod (*op. cit.*, p. 199) spoke of this muscle as being "Ciconine" in the Cuculidae. This is not true of *Coua caerulea*. In this species, the structure of M. expansor secundariorum apparently is unlike that in any bird previously described in that it is a double muscle. The larger, deeper part

arises by a strong, flat tendon from the entepicondyle of the humerus, distal to the origin of M. pronator brevis and superficial to the other tendons arising there (see Burt, *loc. cit.*, who found this part of the muscle in woodpeckers). It inserts by fleshy fibers on the bases of the distal tertials and secondaries 9 and 10 (outermost counted as first). The superficial portion arises by a broad aponeurosis attached along a narrow line on the dorsomedial edge of the scapula and is fused also with the fascia covering the medial surface of M. subscapularis. The aponeurosis tapers to a thin tendon which passes ventrad mesial to the bellies of Mm. dorsalis scapulae and latissimus dorsi pars posticus and parallel to the humerus. A short distance above the elbow, a 15 mm.-long, fleshy belly forms and passes through the internal tricipital groove to insert on the palmar surface of the bases of secondaries 8, 9, and 10 (this is the part of the muscle described and illustrated for several species by Garrod, Fürbringer, Forbes, and Gadow).

M. BRACHIALIS (fig. 1)

M. brachialis arises over an area about 3.5 mm. long and 1.5 mm. wide from the brachial impression on the palmar aspect of the distal end of the humerus. It inserts over an area 6 mm. long on the brachial impression of the ulna between the areas of origin of Mm. flexor digitorum profundus (posterior to it) and extensor pollicis longus (anterior). M. brachialis is fleshy throughout.

M. EXTENSOR METACARPI RADIALIS (figs. 1, 3)

The single fleshy belly of this muscle is about 30 mm. long. It arises both fleshy (superficially) and tendinous (on its deep aspect) from the ectepicondylar process of the humerus. A strong, flat tendon forms near the distal end of the muscle and passes through the tendinal grooves on the radius and the radiale. It inserts on the extensor process of metacarpal I, superficial and anterior to the insertion of M. extensor pollicis longus. M. abductor pollicis arises from the tendon of insertion of M. extensor metacarpi radialis. M. tensor patagii brevis sends a strong fascial band into the muscular fascia covering the belly of M. extensor metacarpi radialis 10 mm. distal to its origin.

M. EXTENSOR DIGITORUM COMMUNIS (fig. 3)

This muscle arises tendinous from the lateral supracondylar ridge (i. e., distal to the ectepicondylar prominence) deep to the tendon of origin of M. flexor metacarpi radialis. The tendon forms on the deep aspect of the belly, which is about 27 mm. long. The tendon passes through a fibrous canal on the ulnar condyle, where it lies superficial to the tendon of M. flexor metacarpi radialis. The tendon bifurcates opposite the base of the pollex. The short tendon inserts on a tubercle on the postero-proximal corner of the pollex. The long tendon runs along the bases of the primaries in a groove on metacarpal II; near the middle of the carpometacarpus it passes deep to the tendon of M. extensor indicis longus, to insert on the postero-anconal surface of the proximal phalanx of digit II.

M. SUPINATOR BREVIS (figs. 2, 4)

This is a long thin muscle closely applied to the anterior surface of the radius. It arises tendinous from the lateral supracondylar ridge between the origins of Mm. anconeus and extensor digitorum communis. The fleshy belly is about 23 mm. long. It inserts fleshy on the anteroproximal surface of the radius beginning 3 mm. from the proximal articular surface and extending distad 21 mm.

M. FLEXOR METACARPI RADIALIS (fig. 3)

This muscle arises by a Y-shaped tendinous band, whose proximal attachment is on the lateral supracondylar ridge proximal to the origin of M. anconeus and super-

ficial to the origin of Mm. extensor digitorum communis and supinator brevis. The distal attachment of the band is on the anconal surface of the ulna about 5 mm. from the proximal articular surface. Fleshy fibers begin 8 mm. from the humeral origin. The fleshy belly is 25 mm. in length and gives way to a stout round tendon at the distal end of the ulna. The tendon passes around the lateral surface of the external condyle in a fibro-osseous canal and inserts on the flexor tuberosity of metacarpal II opposite the proximal limit of the intermetacarpal space.

M. PRONATOR BREVIS (fig. 1)

The most proximal origin of those muscles arising on the posterodistal surface of the humerus is that of M. pronator brevis. It arises by a strong, flat tendon proximal to the entepicondylar eminence and the origin of M. pronator longus. Fleshy fibers form almost immediately, cross M. brachialis, and extend about three-fourths the way down the radius. The total length of the belly is 32 mm. It inserts fleshy on the radius beginning about 2 mm. distal to the biceps insertion and extending to within 9 mm. of the distal end of the bone.

M. PRONATOR LONGUS (fig. 1)

This muscle arises by a strong tendon from the entepicondylar process adjacent to the origin of M. flexor digitorum sublimus and under cover of the humeral tendon of origin of M. expansor secundariorum. Fleshy fibers arise from the deep surface of the tendon at its origin. The total length of the fleshy belly is 37 mm. The insertion is semitendinous proximally, but fleshy distally, on the ulnar side of the radius beginning 7 mm. from the proximal articular surface and extending to the distal end of the bone. The semitendinous portion of the insertion is shared by the origin of M. extensor indicis longus.

M. EXTENSOR POLLICIS LONGUS (figs. 2, 3, 4)

The long extensor of the pollex takes origin from both radius and ulna. It arises from the anterior (radial) surface of the ulna beginning 1 mm. from the proximal articular surface and extending distad 16 mm., and from the ulnar surface of the radius beginning 6 mm. from the head and extending distad 18 mm. The belly fills most of the interval between radius and ulna in the proximal two-thirds, where the belly lies in contact with the interosseous membrane. The tendon forms near the distal end of the ulna and passes through a groove on the radiale to insert on the extensor process of metacarpal I.

M. ANCONEUS (figs. 3, 4)

This muscle arises from the lateral supracondylar ridge immediately distal to the origin of M. flexor metacarpi radialis and superficial to the origin of M. supinator brevis. The fleshy belly is 25 mm. long. It inserts by fleshy fibers on the anterior surface of the ulna beginning 3.5 mm. distal to the proximal articular surface and extending distad 22 mm. Throughout all but its proximal portion it is separated from Mm. extensor pollicis longus and extensor indicis longus by the interosseous membrane.

M. EXTENSOR INDICIS LONGUS (figs. 2, 4)

This muscle arises mostly by fleshy fibers from the ulnar surface of the radius beginning 6 mm. from the proximal articular surface and extending distad 24 mm. The tendon forms at the distal end of the ulna, passes through the interval between ulna and radiale, and down the anterior edge of metacarpal II, where it passes superficial to the tendon of M. extensor digitorum communis. It inserts on the base of phalanx 2, digit II, between the areas of insertion of Mm. interosseous dorsalis and flexor digitorum profundus.

M. FLEXOR DIGITORUM SUBLIMUS (fig. 1)

This complicated muscle has a fleshy belly about 20 mm. long. It arises by a cord-like tendon from the entepicondylar process distal to the origin of M. pronator longus and under cover of the humeral tendon of M. expansor secundariorum. Fleshy fibers begin about 12 mm. distal to the origin of the tendon; about 10 mm. from its origin the tendon fans out to a width of 5 mm., covering the posterior flat surface of the belly. Dorsally, this tendinous sheet attaches to the bases of the eight distal secondaries, and distally it attaches to the base of the ulnare. The main tendon of insertion, however, forms at the level of the ulnare and swings around a fibrous-covered groove on the anterior surface of that bone. On the manus, the tendon grooves the belly of M. abductor indicis, and near the distal end of the carpometacarpus it passes deep to the tendon of M. flexor digitorum profundus. It inserts on the anteropalmar corner of the base of the proximal phalanx of digit II. Shufeldt (1890) apparently considered this muscle as part of M. flexor carpi ulnaris.

M. FLEXOR DIGITORUM PROFUNDUS (figs. 1, 2)

This muscle arises over an area 27 mm. long on the ulna beginning 2 mm. from the proximal articular surface and extending distad to the origin of M. flexor carpi ulnaris brevis. In position it lies deep to M. flexor digitorum sublimus and superficial to M. flexor carpi ulnaris brevis. Its fleshy belly is 33 mm. long. A strong tendon forms at the distal end of the ulna and swings around the anterior surface of the pisiform process, after which it grooves the superficial surface of M. abductor indicis in its course distad. It crosses superficial to the flexor digitorum sublimus tendon and then continues along the anteropalmar surface of digit II to insert on the base of its distal phalanx.

M. FLEXOR CARPI ULNARIS (fig. 1)

This is the largest muscle of the forearm. It arises by a short (3 mm. long), stout tendon from the distal end of the entepicondyle of the humerus. At its origin the tendon is surrounded by a fibrous humero-ulnar pulley (Shufeldt, 1890: 142). The heavy fusiform belly extends the entire length of the ulna and inserts on the proximal face of the ulnare. A secondary fleshy belly arises from the deep surface of the tendon of origin and from the humero-ulnar pulley. This belly runs parallel to the main belly and gives off fleshy fibers which insert into the bases of the eight distal secondaries.

The humero-ulnar pulley attaches to the inner aspect of the entepicondyle of the humerus and to the posterior surface of the ulna just distal to the proximal articular surface.

M. FLEXOR CARPI ULNARIS BREVIS (figs. 1, 2)

This is a short muscle 10 mm. in length. It arises primarily from the anterior surface of the ulna beginning at the distal end of the area of origin of M. flexor digitorum profundus, *i. e.*, about 9 mm. from the distal end of the ulna. The origin and belly are covered by a dense fascia which also serves as origin for the most distal fibers of M. flexor digitorum profundus. The strong, flat tendon passes through a groove on the radiale, under cover of the tendons of Mm. extensor metacarpi radialis and extensor pollicis longus, and around to the anconal surface of the manus where it inserts on the base of the carpometacarpus adjacent to the area of origin of M. extensor pollicis brevis.

M. ABDUCTOR POLLICIS (fig. 1)

This is a well developed and complicated muscle consisting of two parts. The overall length of the fleshy fibers is 11 mm. The larger part arises fleshy from the

superficial surface of the inserting tendon of M. extensor metacarpi radialis. A strong tendinous band forms superficially near the middle of the anterior edge of this belly. This tendon-sheet inserts into somewhat more than half of the palmar surface of the pollex and forms a sheath over the deeper belly. The latter part of the muscle arises by a tendon (5 mm. long) from the deep surface of the tendon of M. extensor metacarpi radialis. This tendon gives rise to a fusiform belly about 5 mm. long, which inserts fleshy on the basal half of the palmar surface of the pollex.

M. ADDUCTOR POLLICIS (fig. 2)

This small muscle arises semitendinous from the anteropalmar surface of metacarpal II at the base of the extensor process. It inserts semitendinous about midlength on the posterior ridge of the pollex.

MM. FLEXOR DIGITI III AND FLEXOR BREVIS DIGITI III (figs. 1, 3)

The separation into two muscles of the flexor mass to digit III in *Coua caerulea* seems to me to be an arbitrary matter. Furthermore, this muscle mass shows a closer relationship to M. flexor metacarpi posterior than in other genera of cuckoos I have studied. That portion of the muscle mass which may be considered to correspond to M. flexor digiti III in other birds arises by a small slip of fleshy fibers from a groove on the posterior surface of metacarpal III near the distal end of that bone. The rest of the muscle mass (M. flexor brevis digiti III) arises from the posteropalmar and distal surfaces of metacarpal III over an area about 5 mm. long. The muscle fills the interval between the distal end of metacarpal III and the posterior spine of digit III. Insertion is mostly by fleshy fibers on the posterior surface of digit III including the posterior spine, as well as on the anconal surface of the digit distal to the spine.

M. INTEROSSEOUS DORSALIS (fig. 3)

Lying in the intermetacarpal space, this muscle arises by fleshy fibers from metacarpals II (for a distance of 7 mm.) and III (for a distance of 6 mm.). From a midline raphe, a strong cord-like tendon forms near the distal end of the carpometacarpus and inserts on the base of phalanx 2, digit II, adjacent to the insertion of M. extensor indicis longus.

M. INTEROSSEOUS PALMARIS (figs. 2, 4)

Similar in structure to the last described muscle, M. interosseous palmaris arises by fleshy fibers over an area 8 mm. long on metacarpal II, and 9 mm. on metacarpal III. The tendon forms as a raphe, passes distad in the interval between digits II and III, and inserts on the posterior surface of phalanx 2, digit II, a short distance beyond the middle of the phalanx. Fleshy fibers cover the tendon to about the level of the posterior spine of digit III.

M. EXTENSOR POLLICIS BREVIS (fig. 3)

This is a well developed fleshy muscle 7 mm. in overall length. It arises from the anconal surface of the extensor process of metacarpal I and from the adjacent area on the base of the carpometacarpus beginning immediately distal to the insertion of the tendon of M. flexor carpi ulnaris brevis. It inserts fleshy on the anteroanconal corner of the base of the pollex.

M. ABDUCTOR INDICIS (fig. 1)

This is a strong muscle about 15 mm. in length. It arises by fleshy fibers from the posterior face of the pisiform process and the anterior surface of metacarpal II for a distance of 13 mm. distal to the pisiform process. It inserts mostly tendinous or

the anterior corner of the base of the proximal phalanx of digit II adjacent to the insertion of M. flexor digitorum sublimus.

M. FLEXOR POLLICIS (fig. 2)

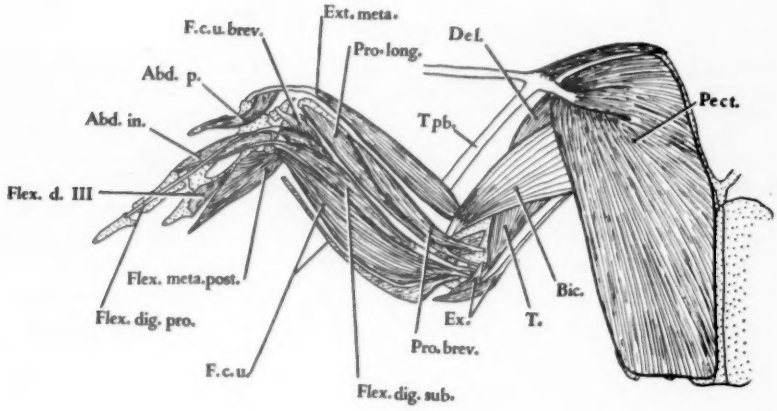
This is a short (5 mm. long) muscle arising fleshy primarily from the anterior surface of the base of the pisiform process. It is bounded posteriorly by the belly of M. abductor indicis. The tendon of M. flexor digitorum profundus, in its course around the pisiform process, passes between Mm. abductor indicis and flexor pollicis. The latter inserts semitendinous on a tubercle on the posterior aspect of the base of the pollex.

M. FLEXOR METACARPI POSTERIOR (figs. 1, 3)

This strong muscle arises by a flat tendinous band from a ridge located about 3 mm. from the distal end of the anconal surface of the ulna. Fleshy fibers cross the wrist joint and insert on the posterior surface of metacarpal III for a distance of 8 mm. Fleshy fasciculi also insert on the bases of the six proximal primaries (1 through 6); a small tendon inserts on the tip of the posterior spine of digit III. The insertion on metacarpal III is closely related to the areas of origin of Mm. flexor digiti III and flexor brevis digiti III.

LIST OF ABBREVIATIONS USED IN FIGURES 1–4

Abd. in.—Abductor indicis
Abd. p.—Abductor pollicis
Add. p.—Adductor pollicis
An.—Anconeus
Bic.—Biceps brachii
Cb. ant.—Coracobrachialis anterior
Cb. post.—Coracobrachialis posterior
Del.—Deltoideus major
Del. min.—Deltoideus minor
Dor. scap.—Dorsalis scapulae
Ex.—Expansor secundariorum
Ext. dig.—Extensor digitorum communis
Ext. in. l.—Extensor indicis longus
Ext. meta.—Extensor metacarpi radialis
Ext. p. brev.—Extensor pollicis brevis
Ext. p. long.—Extensor pollicis longus
F. c. u.—Flexor carpi ulnaris
F. c. u. brev.—Flexor carpi ulnaris brevis
Flex. d. III—Flexor digiti III and Flexor brevis digiti III
Flex. dig. pro.—Flexor digitorum profundus
Flex. dig. sub.—Flexor digitorum sublimus
Flex. meta.—Flexor metacarpi radialis
Flex. meta. post.—Flexor metacarpi posterior
Flex. p.—Flexor pollicis
Inter. dor.—Interosseous dorsalis
Inter. palm.—Interosseous palmaris
Lat. dor. P. ant.—Latissimus dorsi pars anterior
Lat. dor. P. post.—Latissimus dorsi pars posterior
Pect.—Pectoralis superficialis
Pro.—Proscapulohumeralis
Pro. brev.—Pronator brevis
Pro. long.—Pronator longus
Rhom. pro.—Rhomboideus profundus
Rhom. sup.—Rhomboideus superficialis
Sub.—Subcoracoideus
Sup. brev.—Supinator brevis
Supra.—Supracoracoideus
Stern.—Sternocoracoideus
T.—Triceps
T. ext.—Triceps external head
T. int.—Triceps internal head
T. p. b.—Tensor patagii brevis
T. p. l.—Tensor patagii longus
Tr.—Triceps scapular head



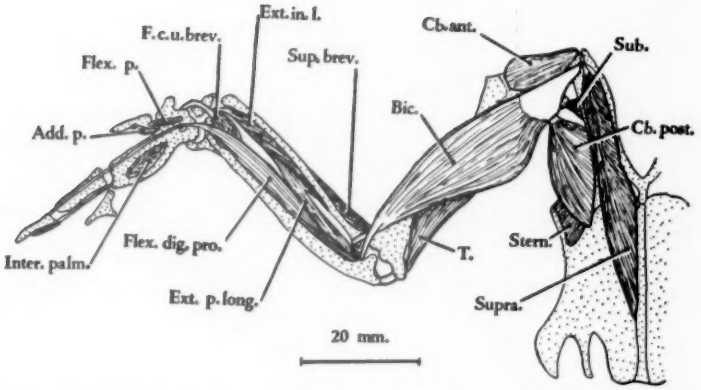
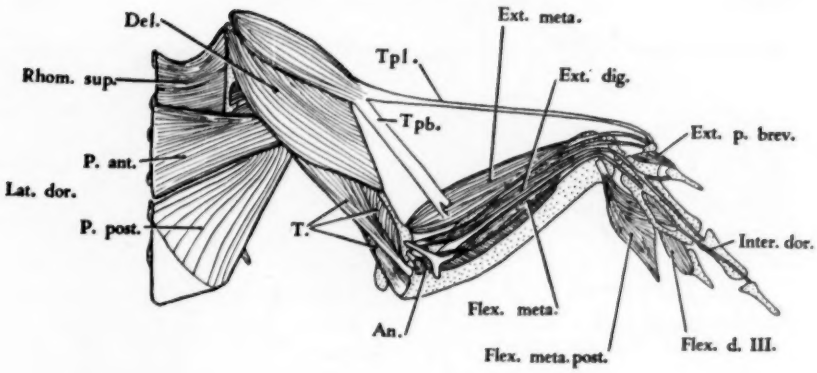


FIGURE 1. (*Top*) *Coua caerulea*. Superficial muscles of the palmar surface of the right wing and pectoral region.

FIGURE 2. (*Bottom*) *Coua caerulea*. Palmar view showing a second layer of muscles.



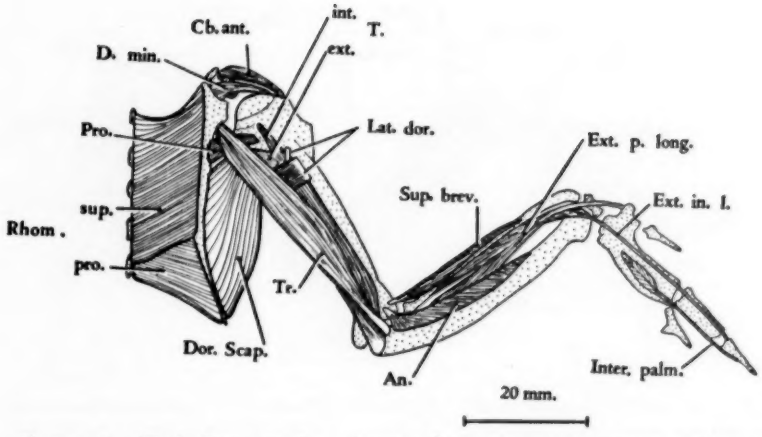


FIGURE 3. (*Top*) *Coua caerulea*. Superficial muscles of the anconal surface of the right shoulder and wing.

FIGURE 4. (*Bottom*) *Coua caerulea*. Anconal view showing a second layer of muscles.

DESCRIPTION OF LEG MUSCLES

M. ILIOTROCHANTERICUS POSTICUS (fig. 6)

The area of origin of this muscle covers the entire anterior iliac fossa, extending from the median dorsal ridge to the ventral margin of the ilium immediately dorsal to the origin of M. iliotrochantericus anticus. The origin is fleshy from the anterior iliac fossa, the posterior surface of the anterior iliac process, the median dorsal ridge, and the anterior iliac crest to a point dorsal to the center of the acetabulum. Fleshy fasciculi also arise from the superficial aponeurosis covering M. iliotrochantericus anticus. M. iliotrochantericus posticus inserts by a 3 mm.-wide, heavy tendon on an elevation on the lateral surface of the femur immediately distal to the trochanter.

M. ILIOTROCHANTERICUS ANTICUS (figs. 6, 7, 8)

This muscle arises by fleshy fibers on its deep surface, and by a dense aponeurosis on its superficial surface, from the posterior face of the anterior iliac process (See Berger, 1952: 516) and the ventrolateral edge of the ilium for a distance of 10 mm. The belly tapers to a width of 2.5 mm. at the femur where it inserts by a 3 mm.-long tendon on a tubercle 7 mm. distal to the trochanter.

M. ILIACUS

I did not find this muscle in either specimen. There is, however, a strong, fibrous ligament which attaches to the lateral surface of the ischium dorsal to the base of the pectineal process and immediately in front of the anterior rim of the acetabulum. Its other attachment is to the medial surface of the femur about 2 mm. distal to the trochanter and similar in position to the insertion of M. iliacus in other cuckoos I have examined. That this ligament represents M. iliacus is open to question.

M. AMBIENS (figs. 7, 8)

The ambiens muscle is the most mesial muscle on the anteromesial aspect of the thigh. It is a strap-like muscle whose fleshy belly is 38 mm. long and 7 mm. in maximum width. It arises by a band-like aponeurosis over an area 2.5 mm. wide from the pectineal process, with some fleshy fibers arising from the lateral surface of that process. Near the proximal surface of the patella the belly tapers to a flat tendon which enters the patellar tendon and passes diagonally downward and laterad around the front of the knee. About 6 mm. distal to the fibular head, the tendon fuses with a broad tendinous band formed as a ventral prolongation of the proximal and third arms of the biceps loop. The resulting complex runs distad for a total distance of 35 mm. and serves as the sole origin for the anterior head of M. flexor perforatus digiti IV and serves as a tendon of origin for fleshy fibers of Mm. flexores perforati digiti II and III.

M. SARTORIUS (fig. 5)

The sartorius muscle is a long strap-shaped muscle arising by a short aponeurosis from the anterior 7 mm. of the median dorsal ridge and from the tendons of M. longissimus dorsi dorsal to the fourth dorsal vertebra, but does not arise directly from its neural spine. The belly is intimately fused with the anterior edge of M. iliotibialis in its proximal half. M. sartorius inserts fleshy on the anteromesial edge of the patellar tendon beginning at the level of the sesamoid, and it also inserts on the superior surface of the inner cnemial crest.

M. ILIOTIBIALIS (figs. 5, 8)

This is the most expansive muscle of the thigh. It covers all other muscles on the lateral aspect except for parts of Mm. semitendinosus, semimembranosus, pars

caudofemoralis of the piriformis, and sartorius. It arises by an aponeurosis attached along a curved line on the anterior iliac process, the median dorsal ridge, and the anterior iliac crest, and both fleshy and semitendinous (on the deep surface) from all but the posterior 5 mm. of the lateral surface of the posterior iliac crest. The muscle is fleshy in its anterior and posterior portions, the middle of the latter being about six times as thick as the sheet-like anterior portion. A thin aponeurotic sheet (32 mm. long and 8 mm. in maximum width) lies between the fleshy portions in the distal two-thirds of the muscle. The tendon of M. iliotibialis contributes to the patellar tendon which inserts on the rotular crest of the tibiotarsus.

M. FEMOROTIBIALIS EXTERNUS (fig. 6)

This muscle may be considered to have two heads although the areas of origin are continuous. It arises fleshy from the entire lateral surface of the femur, beginning on a level with the insertion of M. iliotrochantericus anticus and extending distad to the proximal attachment of the biceps loop. The anteromedial portion of the belly is fused throughout most of its extent with M. femorotibialis medius. The tendon of M. femorotibialis externus contributes to the formation of the patellar tendon. What may be considered a second portion of this muscle complex arises by fleshy fibers and by a dense aponeurosis along a narrow area on the distal half of the femur lateral to the area of insertion of M. accessorius. The fleshy fibers form a separate head whose tendon contributes to the posterolateral portion of the patellar tendon.

M. FEMOROTIBIALIS MEDIUS (figs. 6, 8)

This muscle arises tendinous from the trochanteric ridge and the femur distal to it, and fleshy from the anterior surface of the femur extending from its proximal end to the attachment of the proximal arm of the biceps loop. Except at their proximal origins, where they are separated by M. iliotrochantericus anticus, Mm. femorotibialis externus and medius are intimately fused. The fleshy fibers of the latter muscle insert on the entire proximal surface of the patella, while its tendon contributes to the formation of the patellar tendon.

M. FEMOROTIBIALIS INTERNUS (fig. 8)

This muscle arises from the medial surface of the femur beginning 10 mm. inferior to the trochanter and extending distad to within 7 mm. of the distal end of the internal condyle. This area of origin lies between the area of origin of M. femorotibialis medius and the area of insertion of M. adductor longus et brevis, pars interna. Two separate tendons form and these insert side by side on a tubercle on the proximomesial corner of the head of the tibiotarsus. The anterior tendon is derived from the proximal fibers of origin, the posterior tendon from the distal fibers.

M. PIRIFORMIS (figs. 5, 6, 7)

The piriformis muscle is composed of two parts.

1. *Pars iliofemoralis* is a bulky muscle arising fleshy from the ventral surface of the projecting posterior iliac crest for a distance of about 12 mm. beginning immediately caudal to the ilio-ischiatic fenestra. It inserts by fleshy fibers on the posterolateral surface of the femur for a distance of 7 mm. beginning 8 mm. distal to the trochanter.

2. *Pars caudofemoralis* is a thin, strap-like muscle which arises by a tendinous band (4 mm. long) from an area 5 mm. wide on the lateral edge of the disc of the pygostyle. The total length of the muscle is about 45 mm., its maximum width near midlength, 8 mm. About four millimeters from the femur, the fleshy fibers give way to a 3 mm.-wide, thin tendinous band which inserts on a diagonal ridge medial

to, but in contact with, the distal insertion area of pars iliofemoralis. The most inferior portion of this tendon sweeps around the inferior margin of pars iliofemoralis to form a much heavier tendinous insertion.

M. SEMITENDINOSUS (figs. 5, 8)

This is the bulkiest muscle in the thigh. It arises primarily by fleshy fibers from the ventral surface of the projecting posterior iliac crest in its caudal 12 mm. The anterior edge of the belly is very thin, but the posterior portion is about 7 mm. thick. The belly passes downward, forward, and outward to the femur. About 13 mm. from that bone, the belly is separated by a ligamentous raphe from a second fleshy belly which has been called M. accessorius semitendinosi (Figs. 6, 7, 8). The latter muscle inserts by fleshy fibers over a distance of 14 mm. on the posterolateral surface of the femur extending distad to the proximal end of the internal condyle. This insertion is lateral to the area of insertion of the distal two-thirds of M. adductor longus et brevis pars externa. The fascial plane between the insertion of the accessorius and the origin of pars media of M. gastrocnemius is indistinct.

The ligamentous raphe bifurcates at the inferior margin of the belly of M. semitendinosus. The superior band (2 mm. wide) continues the same straight course of the raphe and inserts on a ridge on the posteromedial edge of the tibiotarsus 5 mm. distal to its head, where it lies under cover of the tibial attachment of the medial femorotibial ligament. Thus, the superior band crosses medially over the belly of pars media of M. gastrocnemius. The inferior band (2.5 mm. wide) turns sharply downward, crosses the belly of pars media of M. gastrocnemius, and inserts into the fascia covering it, just above the point of fusion of pars media and pars interna of M. gastrocnemius.

I found a strong fibrous connection between Mm. semitendinosus and biceps femoris near the region of formation of their tendons.

M. SEMIMEMBRANOSUS (figs. 5, 6, 7, 8)

This muscle arises by an aponeurosis from the posterior 15 mm. of the ventral edge of the ischium about 3 mm. dorsal to the ischiopubic fenestra. Fleshy fibers form almost immediately in the posterior region of the aponeurosis, but anteriorly their area of origin recedes distad 14 mm.; the anterior 5 mm. of the aponeurosis serves solely for the origin of fleshy fibers of the more superficial and anteriorly located M. adductor longus et brevis, pars externa. Just before entering the crus between pars interna and pars media of M. gastrocnemius, the belly of M. semimembranosus gives way to a flat aponeurotic sheet, about 4 mm. wide and 11 mm. long, which inserts on a curved ridge immediately inferior to the inner cnemial crest. A separate tendinous band passes from the inferior margin of the main tendon at its formation to insert into the fascia of pars interna of M. gastrocnemius. The belly also is connected with M. semitendinosus by a short, strong, fibrous band.

M. BICEPS FEMORIS (figs. 6, 7)

The biceps muscle arises by an aponeurosis from the entire anterior iliac crest and the posterior portion of the median dorsal ridge; this aponeurosis is adherent to the dense fascia covering the superficial surface of M. iliotrochantericus posticus. The biceps muscle also arises by fleshy fibers from the ventral surface of the anterior 7 mm. of the posterior iliac crest, extending caudad to the origin of M. semitendinosus. The heavy fleshy belly tapers to a tendon which passes through the biceps loop behind the knee. The strong round tendon inserts on a tubercle on the posterior face of the fibula 16 mm. distal to its head. The tendon passes superficial to the belly of M. flexor perforatus digiti IV and deep to that of M. flexor perforans et perforatus digiti II.

The proximal arm of the biceps loop (12 mm. long) attaches laterally to a ridge 10 mm. from the distal end of the femur. The distal arm attaches to a tubercle about 5 mm. from the distal end of the fibular condyle. The latter attachment is shared with the origin of the lateral head of pars externa of M. gastrocnemius. A third arm of the biceps loop is present and is similar in structure to that described for other genera of cuckoos (Berger, 1952).

M. ISCHIOFEMORALIS (figs. 6, 7)

This is a wide bulky muscle arising from nearly the entire lateral surface of the ischium beginning at the posterior margin of the obturator foramen and extending to the caudal end of the bone. The upper margin of the belly parallels the area of origin of M. piriformis, pars iliofemoralis and is separated from it only by an aponeurosis. Its lower margin extends to the origin of Mm. semimembranosus and adductor longus et brevis, pars externa. A tendinous sheet forms on the superficial surface of the belly of M. ischiofemoralis in its middle third. Insertion is by an unusually strong tendon (4 mm. long and 2.5 mm. wide) on a diagonally placed ridge on the femur immediately proximal to the area of insertion of M. iliotrochantericus anticus. M. ischiofemoralis inserts on the posterosuperior face of this ridge, while M. iliotrochantericus anticus inserts on its antero-inferior face.

M. OBTURATOR EXTERNUS

This is a bulky muscle which has a continuous origin from the ventral, anterior, and dorsal margins of the obturator foramen. Its fibers surround the tendon of M. obturator internus, but none of its fibers appear to insert on that tendon. The main area of insertion, by fleshy fibers, is medial to the obturator ridge and immediately distal and mesial to the area of insertion of the tendon of M. obturator internus. Some of its fibers insert by a thin aponeurosis dorsal and anterior to the tendon of the latter muscle.

M. OBTURATOR INTERNUS (fig. 8)

This is a triangular muscle arising fleshy from the medial surface of the pubis and ischium beginning at the posterior margin of the obturator foramen and extending caudad to within 5 mm. of the posterior end of the ischium, but extending ventrally to the ischiopubic junction. It arises also by a large head from the ventral and medial surfaces of the ilium inside the pelvis. This belly fills about half of the ilio-ischiatic fenestra. A separate tendon forms from this belly and passes through the obturator foramen before fusing with the larger main tendon. Two distinct tendons form on the remainder of the belly, one from the fibers arising from the pubis, the other from the fasciculi arising from the ischium; these tendons fuse in their course through the obturator foramen. The muscle inserts by a single, large, round tendon on the posterolateral edge of the femur about 2 mm. distal to the trochanter. The superficial surface of the ischial portion of the muscle is covered by a dense fascia which continues into the tendon. Apparently none of the fleshy fibers arise from the ischiopubic membrane.

M. ADDUCTOR LONGUS ET BREVIS (figs. 7, 8)

As in most birds this muscle consists of two distinct parts.

1. *Pars externa* is a bulky muscle which arises fleshy in the region of the ventral edge of the ischium for a distance of 10 mm. beginning at the posterior margin of the obturator foramen. Most of its fibers, however, actually arise from the aponeuroses of Mm. semimembranosus and adductor longus et brevis, pars interna. The belly

passes downward and forward to insert on the posterolateral surface of the femur for a distance of 24 mm. beginning just distal to the insertion of M. piriformis.

2. *Pars interna* is a thinner muscle which arises by a dense aponeurosis from an area 11 mm. long on the ventral edge of the ischium at the dorsal margin of the ischiopubic fenestra, beginning at the posterior margin of the obturator foramen. Fleshy fibers form almost at once in the anterior third, but the posterior two-thirds remain aponeurotic for about a third (15 mm.) the distance down the thigh. It inserts by an aponeurosis on the posteromedial surface of the femur for a distance of 22 mm., extending to a tubercle on the proximal end of the internal condyle.

M. TIBIALIS ANTICUS (figs. 5, 6, 8)

This is a large muscle (65 mm. in length) lying on the anterior aspect of the crus. It arises by two heads. The larger head arises mostly by semitendinous bands, shared with Mm. peroneus longus and flexor perforans et perforatus digiti III, from the inner cnemial crest and the rotular crest, and fleshy from the lateral surface of the outer cnemial crest. The smaller head arises by a stout tendon (6 mm. long) from a pit on the anterodistal end of the external femoral condyle. The spindle-shaped belly fuses with the tibial head about 20 mm. inferior to the head of the tibiotarsus. Near the distal end of that bone, the stout tendon passes under the heavy ligamentum transversum in company with, but superficial to, the tendon of M. extensor digitorum longus. The tendon inserts on a tubercle on the anterior surface of the tarsometatarsus 5 mm. inferior to the proximal articular surface of that bone. At its insertion, the tendon lies between the tendon of M. extensor digitorum longus (medially) and the belly of M. extensor brevis digiti IV (laterally).

M. EXTENSOR DIGITORUM LONGUS (figs. 7, 8)

This muscle arises fleshy from the lateral surface of the inner cnemial crest, the anterior surface of the outer cnemial crest, and from the anterolateral surface of the tibiotarsus for a distance of about 15 mm. Fleshy fibers extend to within 17 mm. of the distal end of the bone. The tendon forms on the posterior margin of the belly, passes under the ligamentum transversum deep to the tendon of M. tibialis anticus, and then under a bony bridge immediately above the condyles. It passes through a fibro-osseous canal on the anteromedial surface of the tarsometatarsus just below its head, where it lies medial to the tibialis anticus tendon and lateral to M. extensor hallucis longus. A short distance above the distal end of the tarsometatarsus, the tendon expands to a width of 7 mm. From the distomedial corner of this expanded sheet, two tendons (one ensheathed by the other for a short distance) pass down the extensor surface of digit II. The medial tendon inserts on the proximal ends of phalanx 2 and the ungual phalanx, whereas the more lateral tendon inserts on the proximal end of the ungual phalanx only. Four tendons pass down the extensor surface of the proximal phalanx of digit III. One inserts on the proximal end of phalanx 2, another on the proximal end of phalanx 3, and the other two on the ungual phalanx. A single broad tendon passes down the dorsal surface of phalanges 1 and 2 of digit IV, after which two separate tendons continue to the proximal end of the ungual phalanx. Attachments are made to the proximal ends of phalanges 2, 3, 4, and the ungual phalanx.

A strong fibrous automatic extensor ligament arises, under cover of the extensor tendon, about the middle of the subterminal phalanges of digits II, III, and IV. These insert on the dorsoproximal surface of the base of the ungual phalanges of those digits. Smaller automatic extensors are present on each phalanx of digit IV.

M. PERONEUS LONGUS (figs. 5, 6)

This muscle arises semitendinous from the outer cnemial crest and the rotular crest, and by a dense fascial sheet (shared with M. tibialis anticus) which attaches on the anterolateral surface of the inner cnemial crest and on a long narrow line on the anteromedial aspect of the tibiotarsus for a distance of 50 mm. It arises also from a dense aponeurosis (shared with M. peroneus brevis) from the fibula and the tibiotarsus distal to it. There is no fleshy origin from the tibiotarsus, although the fleshy belly extends about three-fourths the distance down the crus. The belly covers all but the most distal portions of Mm. tibialis anticus and peroneus brevis. The tendon bifurcates 8 mm. from the distal end of the tibiotarsus. The short tendon inserts on the tibial cartilage. The long tendon passes downward and backward, over the tendon of M. peroneus brevis, the lateral tibial condyle, and the head of the tarsometatarsus, to fuse with the tendon of M. flexor perforatus digiti III about 11 mm. distal to the head of the latter bone.

M. PERONEUS BREVIS (figs. 5, 6)

The fleshy belly of this muscle is about 55 mm. long. It arises by a dense aponeurosis from the anterior surface of the fibula beginning at the level of the biceps insertion and from the tibiotarsus distal to the fibula; and it arises also by fleshy fibers from the lateral surface of the tibiotarsus at the same level and extending distad 50 mm. The tendon forms on the superficial surface of the distal fourth of the belly and passes under a heavy fibrous loop located on the anterolateral surface of the tibiotarsus just above the external condyle. The tendon then runs downward and backward across the external condyle deep to the long tendon of M. peroneus longus to insert on a tubercle on the posteroproximal corner of the tarsometatarsus.

M. GASTROCNEMIUS (figs. 5, 8)

The gastrocnemius muscle complex is composed of three main heads.

1. *Pars externa.* As in the three other genera of cuckoos I have studied, pars externa arises by two heads. The lateral head arises by a dense tendinous envelope from a tubercle on the proximal end of the fibular condyle of the femur. The tendon is intimately fused with the lateral surface of the distal arm of the biceps loop. The medial head arises by a flat tendon from a tubercle on the proximomesial surface of the external condyle, where it lies medial to the biceps loop. The tendon fans out and passes distad on the medial surface of the belly. Eight millimeters distal to its origin the tendon gives way to a short (14 mm. long) fleshy belly which fuses with the lateral head. The resulting muscle fuses with pars media about 25 mm. distal to the femoral origin.

2. *Pars media* arises tendinous from a tubercle on the posteroproximal tip of the internal condyle, and fleshy from a triangular area on the posterior face of the femur immediately above the condyles. This area of origin lies between the insertion areas of Mm. adductor longus et brevis, pars interna (medial) and the accessorius semitendinosi (lateral). It is a small muscle having a total length of 25 mm. and a maximum width of 7 mm. The belly is separated from pars interna by the tibial insertions of Mm. semimembranosus and semitendinosus.

3. *Pars interna* is a well developed muscle covering the anteromedial aspect of the proximal half of the crus and sweeping around to the anterolateral surface to cover part of M. peroneus longus. Pars interna arises fleshy from the medial edge of the patellar ligament and the entire medial surface of the inner cnemial crest, and from the inferior edge of that crest by a strong aponeurosis which extends down the deep surface of the belly. About 17 mm. inferior to the head of the tibiotarsus, the ac-

cessory tendon of M. semimembranosus inserts on the fascia covering the superficial surface of the belly, and immediately below this point pars interna and pars media fuse. Both pars interna and pars externa remain fleshy for about two-thirds the distance down the crus.

The conjoined Tendo Achillis passes over the posterior surface of the tibial cartilage and inserts on the posterior surface of the hypotarsus and on the posterolateral ridge of the tarsometatarsus for nearly its entire length. By fusing with the deep fascia, it completes a fibro-osseous compartment for the flexor tendons.

M. PLANTARIS

This is a small muscle which arises from the posteromedial surface of the tibiotarsus immediately below the internal articular surface. Its maximum width is 3.5 mm. and 32 mm. distal to its origin it tapers to a fine tendon. Distally the tendon fans out to insert on the deep surface of the proximal end of the tibial cartilage, only the tendons of Mm. flexor digitorum longus and flexor hallucis longus lying deep to it.

M. FLEXOR PERFORATUS DIGITI II (figs. 6, 7)

The overall length of the fleshy belly of this muscle is about 45 mm. It is not visible until the following muscles have been reflected: gastrocnemius, and flexores perforati digiti III and IV. The muscle takes its origin from the aponeurosis covering the deep surface of M. flexor perforatus digiti III and from the deep surface of the ambiens tendon complex. The fleshy fibers begin about 15 mm. below the fibular head. The tendon passes downward on the deep surface of M. flexor perforatus digiti III, and through a separate fibrous canal on the lateral surface of the tibial cartilage. The tendon passes from lateral to medial across the intertarsal space, in position deep to all of the flexor tendons except the two long flexors. It then passes through a deep fibro-osseous canal on the posteromedial side of the hypotarsus deep to the tendon of M. flexor perforans et perforatus digiti III and lateral to the tendon of M. flexor perforans et perforatus digiti II. It passes through a separate fibrous canal in the intertrochlear space superficial to the other tendons passing to digit II. The tendon bifurcates near the base of the proximal phalanx of digit II and inserts on both sides of it.

A strong vaginal sheath encloses the flexor tendons of each digit in a fibro-osseous canal. In addition, a strong fibro-elastic band (annular ligament) crosses the plantar surfaces at the bases of digits II and III. These structures serve to hold the tendons close to the bones.

M. FLEXOR PERFORATUS DIGITI III (figs. 6, 7)

This is a large muscle hidden from lateral view through most of its extent by the belly of M. flexor perforatus digiti IV and posteromedially by M. gastrocnemius. It arises in part from the distal extension of the ambiens tendon complex, but the major origin is by a very strong cord-like tendon from the intercondyloid region of the femur. This tendon also serves as origin for some of the fibers of Mm. flexor hallucis longus and flexor perforatus digiti IV. The tendon fans out into a broad sheet (5.5 mm. wide), which passes down the deep surface of flexor perforatus digiti III for a distance of about 50 mm. This sheet serves as the primary origin for M. flexor perforatus digiti II.

Fleshy fibers form about 4 mm. below the femoral origin and extend distad for 57 mm. The belly is intimately fused with Mm. flexores perforati digiti II and IV. The belly tapers to a broad (2 mm.-wide), flat tendon, which is grooved superficially by the tendon of M. flexor perforatus digiti IV in its course through the middle compartment of the tibial cartilage and over the posterior surface of the hypotarsus.

The long tendon of M. peroneus longus inserts into this tendon about 11 mm. inferior to the head of the tarsometatarsus. This is the largest of the flexor tendons, and it passes through the intertrochlear space superficial to the other flexor tendons. It inserts primarily on each side of the distal end of phalanx 1 but has a small attachment on the proximal end of phalanx 2. About 3 mm. distal to the metatarsophalangeal joint, the tendon bifurcates to permit passage of the long flexor tendon.

A vinculum is wanting between the tendons of Mm. flexor perforatus digiti III and flexor perforans et perforatus digiti III.

M. FLEXOR PERFORATUS DIGITI IV (figs. 6, 7)

This muscle arises by two heads. The posterior, or femoral, head arises from the stout tendon of origin of M. flexor perforatus digiti III, and its belly is intimately fused with that muscle. The anterior head arises from the ambiens tendon complex. The overall length of the fleshy belly is 52 mm., fleshy fibers extending to within 31 mm. of the distal end of the tibiotarsus. The belly covers Mm. flexores perforati digiti II and III. The tendon forms on the posteromedial surface of the belly and passes through the tibial cartilage in the middle tendinous compartment, where it grooves the tendon of M. flexor perforatus digiti III. It maintains this same relationship over the posterior surface of the hypotarsus and in the proximal fourth of the tarsometatarsus. Distally the tendon sweeps around the medial surface of the trochlea for digit IV and through a dense fibrous canal on its distal surface. The tendon does not ensheath the tendon of M. flexor digitorum longus, but fans out to insert near the distal end of the proximal phalanx on the plantar and lateral (medial in zygodactyl foot) sides, the plantar attachment being the stronger.

M. FLEXOR PERFORANS ET PERFORATUS DIGITI II (figs. 5, 6)

The length of the fleshy belly of this muscle is 25 mm., of which the proximal 10 mm. are visible superficially. It arises fleshy from the patellar tendon and by a strong aponeurosis which is attached to the patellar tendon and to the lateral surface of the third arm of the biceps loop. A thin band-like tendon forms on the superficial surface of the belly and passes down the leg on the belly of M. flexor perforatus digiti IV and under cover of M. gastrocnemius, pars externa. The belly lies superficial to the ambiens tendon and the femoral head of M. tibialis anticus. The tendon passes through a separate fibrous canal on the posteromedial edge of the tibial cartilage where it is the most medial tendon; it passes through a separate fibrous canal on the medial surface of the hypotarsus, and through another separate fibrous canal in the intertrochlear space deep to the tendon of M. flexor perforatus digiti II. The tendon passes through the bifurcated tendon of M. flexor perforatus digiti II at the base of the proximal phalanx of digit II, and about the middle of that phalanx the tendon bifurcates to permit passage of the tendon of M. flexor digitorum longus. Insertion is on the sides of the base of phalanx 2.

M. FLEXOR PERFORANS ET PERFORATUS DIGITI III (figs. 5, 6)

The total length of the fleshy belly of this muscle is 47 mm., most of which is visible superficially. It arises by fleshy fibers from the patellar tendon and the outer cnemial crest and by a strong aponeurosis (shared with Mm. peroneus longus and tibialis anticus) from the outer cnemial crest. Proximally, the belly is intimately fused with Mm. peroneus longus, tibialis anticus, and flexor perforans et perforatus digiti II. The tendon forms on the posterior edge of the belly and passes diagonally downward from lateral to posteromedial to pass through the medial side of the superficial compartment of the tibial cartilage. The tendon then takes a straight course through a medial fibrous canal on the hypotarsus, where it is lateral

only to the tendon of M. flexor perforans et perforatus digiti II. On digit III the tendon passes between the two tendons of insertion of M. flexor perforatus digiti III, and near the middle of phalanx 2 the tendon bifurcates to permit passage of the tendon of M. flexor digitorum longus. The resulting tendons insert on either side of the base of phalanx 3.

M. FLEXOR DIGITORUM LONGUS (figs. 6, 7)

This is a large muscle situated deeply on the posterior aspect of the crus. Proximally the belly is Y-shaped. Its total length is 60 mm., its maximum width, 9 mm. It arises fleshy from the posterior surface of the head, neck, and shaft of the fibula, and from the entire posterior surface of the tibiotarsus to within 23 mm. of the distal end of that bone. The tendon passes through the tibial cartilage medial to the tendon of M. flexor hallucis longus and deep to the other flexor tendons, and through the medial bony canal of the hypotarsus. It then passes down the tarsometatarsus from medial to lateral and under the tendon of M. flexor hallucis longus, with which it is united by a vinculum. The greater part of M. lumbricalis arises from the tendon of M. flexor digitorum longus. The tendon trifurcates opposite metatarsal I to supply digits II, III, and IV. The main areas of insertion are on the bases of the ungual phalanges of these digits, but accessory insertions occur on subterminal phalanges as indicated in Figure 7.

M. FLEXOR HALLUCIS LONGUS (figs. 6, 7)

This muscle arises fleshy from the intercondyloid region of the femur (between the attachments of the tendon of M. flexor perforatus digiti III and the distal arm of the biceps loop), from the tendon of M. flexor perforatus digiti III, and from the deep surface of the distal and third arms of the biceps loop. The belly is 32 mm. in length. The tendon passes laterally through the deep surface of the tibial cartilage and through the lateral bony canal of the hypotarsus. On the distal half of the tarsometatarsus, the tendon passes from lateral to medial over the tendon of M. flexor digitorum longus and is united with it by a long (9 mm.) but perforate vinculum. The tendon is ensheathed by the expanded tendon of M. flexor hallucis brevis opposite the metatarsophalangeal joint. It inserts on the proximal end of the ungual phalanx, but there is a small slip given off the deep surface of the tendon to insert on the pad between the proximal and ungual phalanges.

The automatic flexor of the hallux is a tendinous cord which is as large as the tendon of M. flexor hallucis longus. It attaches to the wing of the trochlea for digit IV. Distally it passes over the tendon of the long flexor muscle to attach to the medial side of the base of the ungual phalanx.

M. POPLITEUS

This is the most deeply situated muscle on the posterior aspect of the crus, lying deep to and between the fibular and tibial heads of M. flexor digitorum longus. Its dimensions are: 6 mm. in length; 5 mm. wide at its origin on the posteromedial surface of the head and neck of the fibula; 3 mm. wide at its insertion on the popliteal ridge on the tibiotarsus a little distal to the origin.

M. EXTENSOR HALLUCIS LONGUS (figs. 6, 7, 8)

The long extensor of the hallux arises fleshy from a long area on the anteromesial surface of the tarsometatarsus beginning immediately below the head and extending distad 35 mm. Its tendon lies adjacent medially to the belly of M. abductor digiti II, passes under a fibrous loop on metatarsal I, and bifurcates opposite the base of

the proximal phalanx. The two tendons pass along the extensor surface of the hallux to insert in common on the base of the ungual phalanx.

A strong automatic extensor ligament of the claw of the hallux arises about the middle of the proximal phalanx and inserts with the extensor tendon (Fig. 7).

M. EXTENSOR PROPRIUS DIGITI III (figs. 6, 8)

This short fleshy muscle lies on the anterior surface of the distal half of the tarsometatarsus, between Mm. extensor brevis digiti IV and abductor digiti II, with which muscles it is intimately fused. The belly is narrow at its proximal origin, but increases in bulk distally. Its origin begins 25 mm. below the head of the tarsometatarsus and extends distad about 22 mm. The fleshy fibers insert on the proximal surface of a sesamoid bone and the broad (3 mm. wide) tendon inserts on the entire dorsal surface of the base of the proximal phalanx of digit III.

M. EXTENSOR BREVIS DIGITI IV (fig. 5)

This is the largest muscle on the anterior aspect of the tarsometatarsus. It arises fleshy from the anterolateral surface of that bone beginning just below the proximal articular surface and extending distad for 40 mm. The tendon forms as a band-like tendinous raphe, but becomes extremely strong at the distal end of the tarsometatarsus, where it passes through a fibro-osseous canal around the anterior surface of trochlea IV. It inserts on the entire medial (lateral in zygodactyl foot) surface of the base of the proximal phalanx of digit IV.

M. ABDUCTOR DIGITI II (fig. 8)

This is a short (16 mm. long), fleshy muscle whose origin is on the anteromedial ridge of the tarsometatarsus beginning 20 mm. from the distal end of the trochlea for digit II and extending distad 14 mm. A few fasciculi arise from metatarsal I. The belly is fused laterally with the belly of M. extensor proprius digiti III, and medially with that of M. extensor hallucis longus. The tendon forms on the superficial surface of the belly and inserts on the dorsomedial corner of the base of the proximal phalanx of digit II.

M. FLEXOR HALLUCIS BREVIS (fig. 8)

The belly of this muscle is 23 mm. in length. It arises fleshy from the medial surface of the hypotarsus and from the posteromedial surface of the tarsometatarsus for a distance of 20 mm. beginning immediately below the head. Near the base of the proximal phalanx of the hallux the tendon becomes a much-expanded fibrous pad which ensheaths the tendon of M. flexor hallucis longus. It inserts on the ventromedial corner of the proximal phalanx of the hallux.

M. ADDUCTOR DIGITI II

The belly of this small muscle is 9 mm. in length. It arises fleshy from the ventral midline of the hypotarsus between and deep to the tendons of Mm. flexor digitorum longus and flexor hallucis longus; it arises also from the posterior sulcus of the tarsometatarsus for a distance of 3 mm. below the hypotarsus. The tendon passes down the posterior sulcus next to the bone and passes through the internal intertrochlear notch to insert dorsolaterally on the base of the proximal phalanx of digit II.

M. LUMBRICALIS

This small muscle arises fleshy primarily from the tendon of M. flexor digitorum longus beginning 13 mm. inferior to the hypotarsus; a few fibers arise from the tendon of M. flexor hallucis longus. It inserts semitendinously on the fibrocartilaginous joint pulley for digit IV.

M. ABDUCTOR DIGITI IV (fig. 7)

The belly of this muscle is about 20 mm. in length, though a few fibers continue distad along the tendon. It arises fleshy from the distolateral corner of the tibial cartilage, the lateral and ventral surfaces of the hypotarsus, and from the posterolateral surface of the tarsometatarsus for a distance of 16 mm. The tendon passes under a heavy fibrous loop on the base of the trochlea for digit IV and inserts laterally (medially in zygodactyl foot) on the base of the proximal phalanx of digit IV.

SUMMARY

The purpose of this paper is to present details of the appendicular osteology and myology of *Coua caerulea*, an interesting and little known cuckoo. Too few genera of this family have been studied to permit speculation on intergeneric relationships. Until it is possible to study other species of the genus *Coua* it seems unwise to make detailed comparisons with New World genera I have studied. Though *Coua caerulea* may not be typical of the genus, one can say that its limb proportions are closer to those of *Geococcyx californianus* than to those of *Crotophaga sulcirostris* or *Coccyzus erythropthalmus*. Furthermore, there are few differences between the total appendicular myology of *Coua caerulea* and that of *Geococcyx*.

Three species of *Coua* have 14 cervical vertebrae each, the last two of which possess cervicodorsal ribs. There are 4 dorsal vertebrae, and four ribs articulate with the sternum. The sternum is double-notched. The number of free caudal vertebrae in four specimens of *Coua caerulea* studied varies from 4 to 6. A basal disc is well developed on the pygo-

LIST OF ABBREVIATIONS USED IN FIGURES 5–8

Abd. d. IV—Abductor digiti IV
Abd. dig. II—Abductor digiti II
Acc.—Accessorius semitendinosi
Add. long. P. ext.—Adductor longus et brevis pars externa
Add. long. P. int.—Adductor longus et brevis pars interna
Auto. ext.—Automatic extensor
Auto. flex.—Automatic flexor
Bic. fem.—Biceps femoris
Bic. loop—Biceps loop
Ext. brev. d. IV—Extensor brevis digiti IV
Ext. dig. l.—Extensor digitorum longus
Ext. hal. l.—Extensor hallucis longus
Ext. pro. d. III—Extensor proprius digiti III
Fem. tib. ext.—Femorotibialis externus
Fem. tib. int.—Femorotibialis internus
Fem. tib. med.—Femorotibialis medius
Flex. dig. l.—Flexor digitorum longus
Flex. hal. brev.—Flexor hallucis brevis
Flex. hal. l.—Flexor hallucis longus
F. p. et. p. d. II—Flexor perforans et perforatus digiti II
F. p. et p. d. III—Flexor perforans et perforatus digiti III
Flex. per. d. II—Flexor perforatus digiti II
Flex. per. d. III—Flexor perforatus digiti III
Flex. per. d. IV—Flexor perforatus digiti IV
Gas., P. ext., P. int., P. med.—Gastrocnemius pars externa, pars interna, pars media
Il. tib.—Iliotibialis
Il. troc. ant.—Iliotrochantericus anticus
Il. troc. post.—Iliotrochantericus posticus
Isch. fem.—Ischiofemoralis
Obt. int.—Obturator internus
Per. brev.—Peroneus brevis
Per. long.—Peroneus longus
Pirif. P. caud. fem.—Piriformis pars caudofemoralis
Pirif. P. il. fem.—Piriformis pars iliofemoralis
Sar.—Sartorius
Semim.—Semimembranosus
Semit.—Semitendinosus
Tib. ant.—Tibialis anticus
Tib. cart.—Tibial cartilage
Vin.—Vinculum

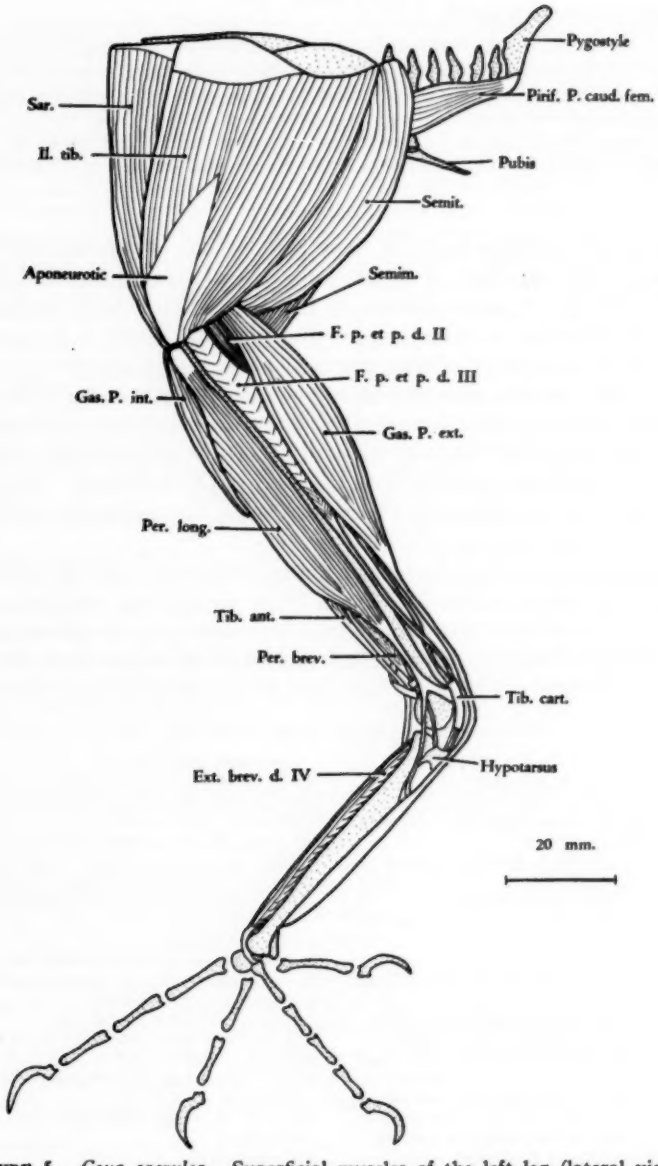


FIGURE 5. *Coua caerulea.* Superficial muscles of the left leg (lateral view).

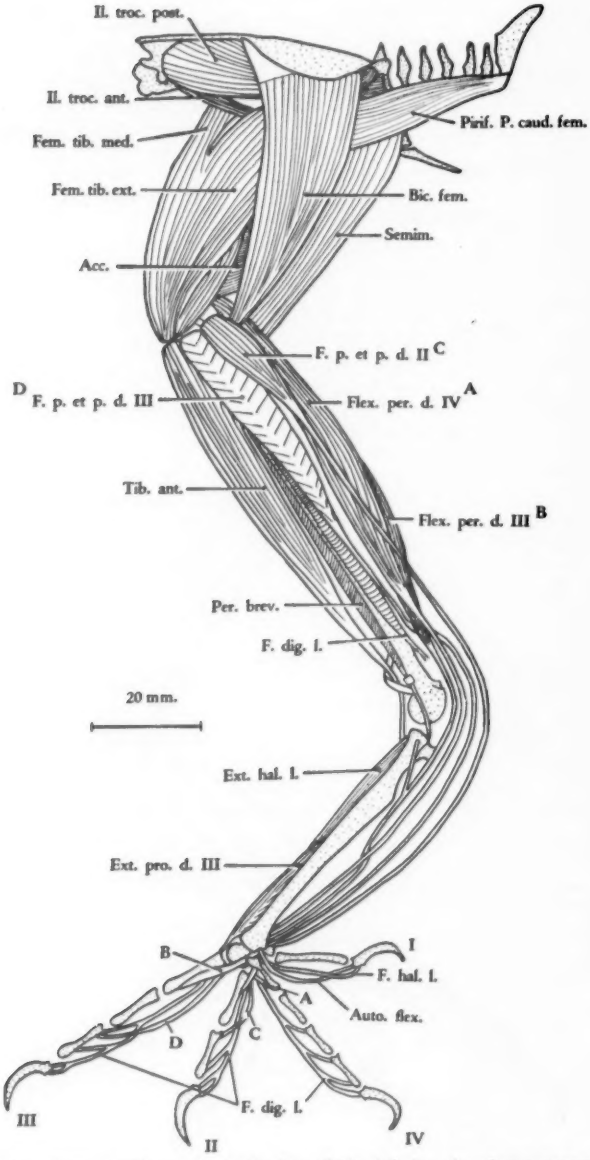


FIGURE 6. *Coua caerulea*. Lateral view of the left leg showing a second layer of muscles.

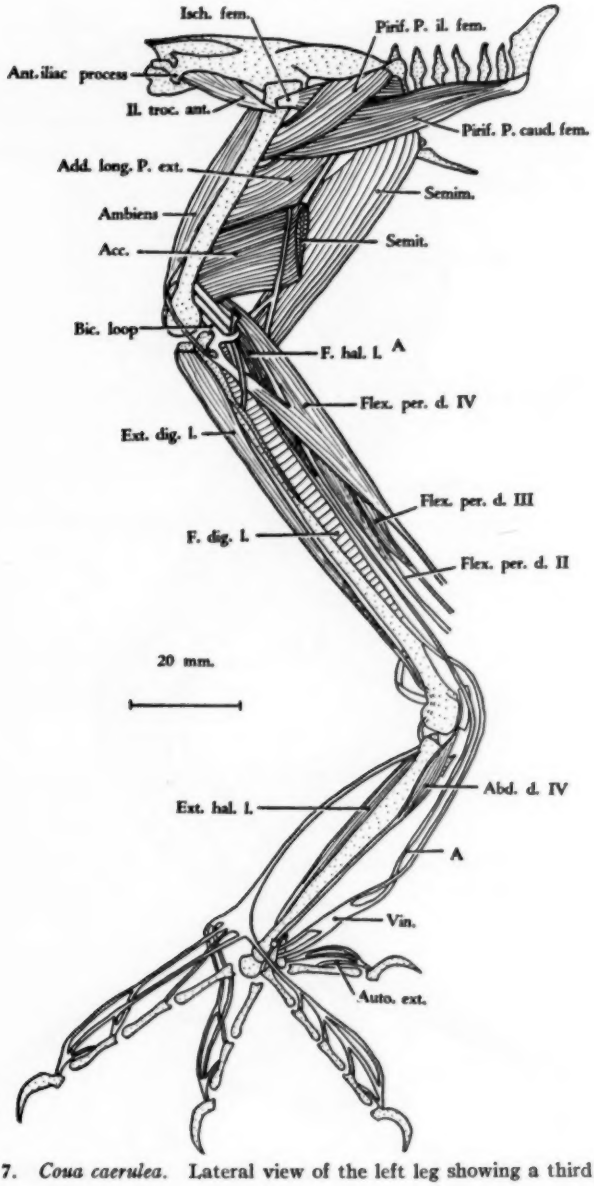


FIGURE 7. *Coua caerulea*. Lateral view of the left leg showing a third layer of muscles.

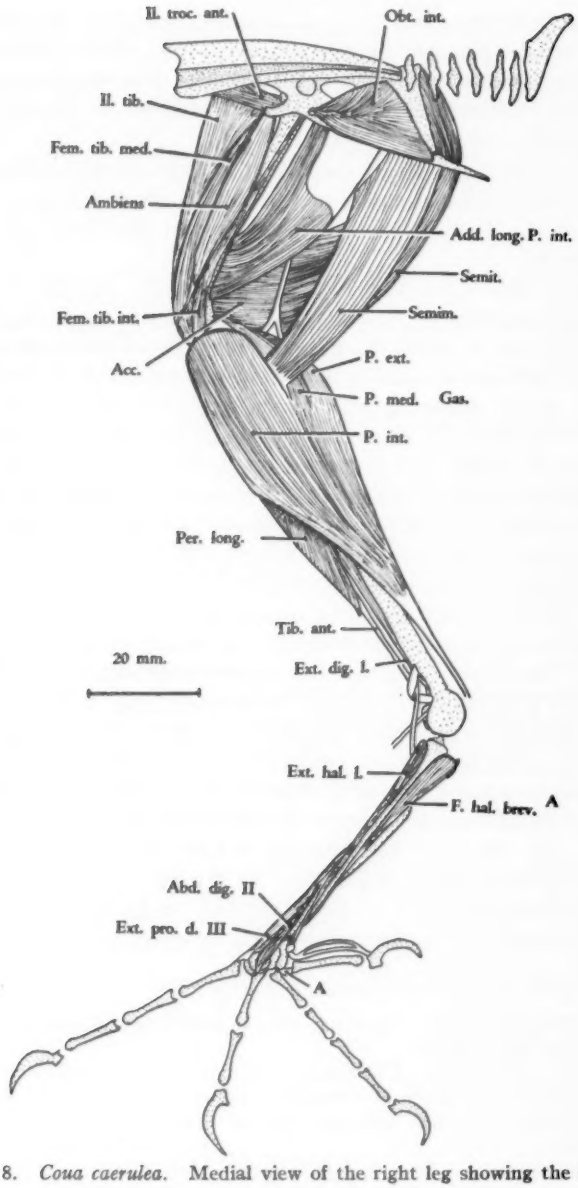


FIGURE 8. *Coua caerulea.* Medial view of the right leg showing the superficial muscles.

style. The bony wing is 50.2 per cent the length of the leg (including digit III), or 62.5 per cent if digit III is excluded. There are two bony canals in the hypotarsus: the lateral canal transmits the tendon of M. flexor hallucis longus; the medial canal transmits the tendon of M. flexor digitorum longus.

The following wing muscles are absent in *Coua caerulea:* proscapulo-humeralis brevis, flexor metacarpi brevis, abductor indicis brevis, abductor digiti II, and the biceps slip to the tendon of M. tensor patagii longus.

A single belly represents Mm. tensor patagii longus et brevis, though their tendons of insertion are entirely separate and distinct. M. deltoideus minor arises from inside the triosseal canal, rather than from the lateral surface of the acromion process of the scapula. M. deltoideus major arises by two heads but has a single continuous insertion. M. expansor secundariorum is present and well developed; its structure is unlike that described previously for other birds. Pars propatagialis musculi cucullaris (M. dermo-tensor patagii of Shufeldt and Fisher) does not insert on the tendon of M. tensor patagii longus.

The leg-muscle formula is ABXYAm. The following muscles are wanting: iliotrochantericus medius, gluteus medius et minimus, iliacus, adductor digiti IV, and extensor brevis digiti III. Especially noteworthy is the absence of M. iliacus. A vinculum is present between the tendons of Mm. flexor digitorum longus and flexor hallucis longus, but a vinculum is wanting between the tendons of Mm. flexor perforatus digiti III and flexor perforans et perforatus digiti III.

There is a tendinous connection between Mm. semitendinosus and semimembranosus, and the latter muscle has an accessory insertion on M. gastrocnemius, pars interna. M. obturator internus is triangular in shape. M. obturator externus has a single head. The tendon of M. flexor hallucis brevis ensheathes the tendon of M. flexor hallucis longus, but the tendon of M. flexor perforatus digiti IV does not ensheath the tendon of M. flexor digitorum longus supplying digit IV.

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GENERAL NOTES

Grebe-Duck Nesting Parasitism.—During a waterfowl nesting study on Swan Lake in Bannock County, Idaho, an unusual instance of social parasitism in nesting was observed.

On June 15, 1951, when it was first found, a typical grebe nest contained three eggs of a Western Grebe (*Aechmophorus occidentalis*) and two eggs of a Pied-billed Grebe (*Podilymbus podiceps*). The eggs of the Western Grebe were darkly stained, and those of the Pied-billed Grebe exhibited much of the chalky blue color that is characteristic of newly-laid eggs of this species. On the basis of this difference in condition, it was concluded that the Pied-billed Grebe was not the owner of the nest. Contrary to the exposed situation of the eggs in other Western Grebe nests on the study area, all eggs in the parasitized nest were partly covered with vegetation.

Two days later, Dr. Jessop B. Low observed the nest. By this time, an egg of the Ruddy Duck (*Oxyura jamaicensis*) had been added. The duck egg had been deposited on top of the vegetation which covered the grebe eggs.

On June 22 when the nest was again visited, the Ruddy Duck egg was gone without a trace.

The dry appearance of the nest indicated that it had been abandoned, but it was not until July 13 that the eggs were opened. The Western Grebe eggs had been incubated for several days before being abandoned, but those of the Pied-billed Grebe were either infertile or had not been incubated.—KEN WOLF, *Utah State Wildlife Research Unit, Utah State Agricultural College, Logan, Utah.*

The Tule Goose (*Anser albifrons gambelli*), Blue Goose (*Chen caerulescens*), and Mottled Duck (*Anas fulvigula maculosa*) Added to the List of the Birds of Mexico.—As the recently published 'Distributional Check-List of the Birds of Mexico' (Friedmann, Griscom, and Moore, 1950) does not include mention of the Tule Goose, Blue Goose, or Mottled Duck, it seems desirable to report the following records from the files of the Fish and Wildlife Service.

During the period December 13, 1950, to February 3, 1951, I was engaged in waterfowl investigations in the vicinity of Ciudad Obregon, Sonora. White-fronted Geese were common. Their numbers ranged from more than 8,000 during late December to about 6,000 in mid-January. Many were shot by visiting hunters from the United States, and in looking at several of the bags of these geese I was impressed by the larger size of some specimens. One specimen of the larger individuals, but not the largest seen, was obtained on January 18, in addition to heads from two others. Dr. Alden H. Miller, in commenting on the specimens sent to him for identification, wrote, "I am willing to call your specimen from Obregon and specimen number two, the head, *gambelli*, although I wish that a more decisive complete specimen, non-intermediate, were available."

The Blue Goose has been recorded in coastal areas of Tamaulipas more or less regularly by me each winter since 1938. Of those seen, most were with Lesser Snow Geese on the deltas of the Rio Grande and the Rio San Fernando. A few were also observed with Lesser Snow Geese on grassy flats west of Tampico.

On the midwinter waterfowl-inventory flights conducted annually by the Fish and Wildlife Service, Robert H. Smith and David L. Spencer recorded totals of 125 and 193 Blue Geese in 1948 and 1949, respectively, among the several thousand Snow Geese present on salt marshes and lagoons of northeastern Tamaulipas. In January, 1951, Walter Crissey and John Ball recorded no Blue Geese in Tamaulipas, but they reported 10 among the Snow Geese observed near Laguna Tamiahua, Veracruz. In

the state of Veracruz, some Blue Geese have been recorded in marshes at the southern end of Laguna Tamiahua; 37 were observed by me among flocks of Lesser Snow Geese in the Papaloapan sector on January 23, 1947.

During January, 1951, Mr. Wiebe of Cuauhtemoc, Chihuahua, an experienced goose hunter and long-time resident of that locality, reported to Mr. George Engleheart of Chihuahua City the killing of a Blue Goose from a flock of Snow Geese. His description of the Blue Goose was accurate in every detail.

The sector near Cuauhtemoc is a famous goose-wintering ground. On February 16, 1947, I estimated a total of 38,260 Snow Geese present on lakes and flats west and northwest of the city of Chihuahua, which area includes two lakes near Cuauhtemoc. Thus, it is not surprising that an occasional Blue Goose accompanies them to this important wintering ground on the Mexican plateau.

The Mottled Duck has been shot by many hunters in coastal marshes and ponds on the Gulf coast near Brownsville, Texas. It is equally common across the Rio Grande in similar marshes and ponds of Tamaulipas. I first observed it in Tamaulipas in 1937, east and southeast of Matamoros on the Arroyo Pita and Arroyo Gomeno.

On a reconnaissance trip from Matamoros southward along the coast to Tamiahua, Veracruz, on February 2 to 4, 1938, I recorded 245. Most were seen in the fresh-water marshes west of Tampico, Tamaulipas.

Since then I have observed the Mottled Duck regularly in that part of Mexico, both during the winter and in the breeding season. No nests were found, but adults with broods of young were recorded occasionally at coastal ponds east of Matamoros from April through June. On a trip to the Rio San Fernando delta, Tamaulipas, July 24 to 26, 1941, I observed two family groups of adults and month-old juveniles. Three other broods of young were seen at Altamira, near Tampico, on July 30, 1941. Localities in Tamaulipas where I have observed this duck during the breeding season are: Matamoros, San Juan (near Laguna San Juan), Tomates, Mogote Largo, Loma Chica, Arroyo de la Pita, Arroyo Gomeno, Anacahuites, a dozen others east and southeast of Matamoros, the vicinity of Barra Jesus Maria, the delta of the Rio San Fernando, Rio Tordo, and Rio Tigre or Cachimbas, the Laguna de San Andres, and near Tampico.

No large numbers have been observed together. To date, the largest flock recorded was one of 16 observed at a fresh-water pond near Anacahuites, a ranch near the north end of Laguna Madre. During the aerial reconnaissance made each January as a part of the Fish and Wildlife Service waterfowl inventory, several hundred Mottled Ducks were seen in the localities listed.

In the state of Veracruz I have recorded this duck in the winter at marshes near the village of Tamiahua, near Tuxpan, near the city of Veracruz, and in several places in the vast delta of the Rio Papaloapan, south of Alvarado.

There is a specimen (No. 419794) in the Fish and Wildlife Service collection taken by me on December 2, 1949, near Tampico, Tamaulipas.—GEORGE B. SAUNDERS, *Fish and Wildlife Service, Atlanta, Georgia.*

A Record of the Green-winged Teal (*Anas carolinensis*) from Puerto Rico.—The Green-winged Teal is a rare winter migrant to the West Indies. It has been recorded from Cuba, Hispaniola, Jamaica, St. Croix, St. Vincent, the Grenadines, Grenada, Barbados, and the Bahamas.

In 1951, the hunting season for ducks began in Puerto Rico on December 15. The second day of the season a Green-winged Teal was collected in the Anegado Lagoon near the town of Lajas, Puerto Rico. The specimen was brought for identification

to the Department of Biology of the College of Agriculture of the University of Puerto Rico. The bird, a beautiful male, is at present in the bird collection of the Department of Biology. The same day two other specimens were collected and reported by Professor Jenaro Maldonado who was making a bird census at the Anegado Lagoon. This bird is apparently a regular winter migrant to Puerto Rico, since several hunters claim they have collected specimens during previous seasons.—VIRGILIO BIAGGI, JR., *Department of Biology, College of Agriculture and Mechanical Arts, Mayaguez, Puerto Rico.*

A Breeding Record for the Ring-necked Duck in Massachusetts.—Since 1938, several articles have appeared recounting breeding records for the Ring-necked Duck (*Aythya collaris*) in the Northeast. Mendall (Auk, 55: 401–404, 1938), Peters (Auk, 58: 401–402, 1941), and Squires (Auk, 63: 600, 1946) discussed breeding trends in Maine, Prince Edward Island and Nova Scotia, and New Brunswick, respectively. The breeding population in New Brunswick is apparently one of quite long standing, but recent nesting in other northeastern areas is without historical precedent. While migrant Ring-necks have become increasingly common in Massachusetts, I have found no previous nesting records in New England south of Maine.

Observers of the spring migration through the Great Meadows National Wildlife Refuge in Concord, Massachusetts, have been aware of the tendency of a small number of Ring-necks to linger into May and June. Considerable interest was aroused in the possibility of a pair remaining to nest on or about the refuge. The event was, in fact, predicted by Griscom (Birds of Concord, 1949: 190). During April, 1951, as many as 40 Ring-necks were observed on the refuge impoundments, but only one pair remained after the first week in May. Their behavior was observed by David Grice. The apparent territorial behavior of the male and the repeated presence of the female in a particular section of the marsh led him to believe that a nesting attempt was being made, although his searches for the nest did not disclose it.

On the morning of May 22, the writer, using a Labrador Retriever dog, flushed the duck from the nest. It was situated on a semi-floating island of decayed plant material about five yards out from the hummocky zone which lines the shores of the impoundment. The nest was placed in a small grassy tussock shaded by a sparse buttonbush. The 12 olive-buff eggs were a scant two inches above the surface of the water. A sample of the down and breast feathers was removed and later identified as that of a Ring-necked Duck. Late in the afternoon, Joseph A. Hagar, State Ornithologist, accompanied the writer as the nest was reapproached by canoe. The duck was observed from a distance of less than ten feet, making positive visual confirmation of her identity possible.

On May 26, after several days of rain, the nest was found to contain only broken shells and membranes. In spite of the obscuring effects of the rain and the earliness of the season, it is believed that the clutch may have hatched successfully. While the brood has not been observed, few of the broods known to be hatched on the marsh are seen, owing to the density of the emergent vegetation present. Indeed, the nest itself could easily have gone undiscovered. Although it was located within 70 feet of a regularly visited Wood Duck box, and was in plain view of an observation tower less than 300 feet distant, the duck had kept her nest secret until scented by the dog. It seems altogether possible, therefore, that nests occurred here in previous years when Ring-necks were observed in late May and June.—EMERSON H. CHANDLER, *285 Webster St., Auburndale, Massachusetts.*

Broad-winged Hawk (*Buteo platypterus*) Feeds on Evening Bat.—About 9:30 a. m., on July 30, 1951, in a stand of water oak slightly west of Tifton, Tift County, Georgia, I collected an adult male Broad-winged Hawk whose stomach remains consisted entirely of fur, a few postcranial bones, and a virtually undamaged skull of the Evening Bat (*Nycticeius humeralis*). The general shape and complete dentition of the skull enabled me to identify the bat, both through keys and comparison with specimens in the Museum of Vertebrate Zoology. This is the first instance of chiropteran food of the Broad-winged Hawk that has come to my attention, none having been cited in Burns' monograph on the species (Wilson Bull., 23: 139–320, 1911) or in Bent's life-history account (U. S. Natl. Mus. Bull. 167: 244–246, 1937). In fact, neither the latter work nor G. M. Allen's "Bats" (Harvard Univ. Press, p. 280 ff., 1939) gives a single instance of bat-feeding by any of the buteonine hawks. It therefore seems likely that only rarely do buteos succeed in capturing bats. It seems equally likely that individuals falling prey to these hawks are caught resting rather than on wing.—ROBERT A. NORRIS, *Museum of Vertebrate Zoology, University of California, Berkeley 4, California.*

A Great Flight of Dovekies (*Plautus alle*).—The Dovekie is known as a bird of the open sea. Forbush (Birds of Massachusetts . . . Vol. 1: 49) says it "seldom appears in great numbers near shore unless driven in by severe storms." Murphy and Vogt (Auk 50: 325–349, 1933) state: "it is distinctly an off-shore, rather than littoral species." Numbers of these birds have been seen, both along shore and driven inland, during and after storms, but a heavy migration in fair weather appears to be an unknown occurrence, and thus worth recording.

The greatest invasion of Dovekies known are those of 1871 and 1932. It is recorded by William Brewster (Birds of the Cambridge Region, pp. 90–91) that on November 15, 1871, a violent easterly storm, with torrents of rain and exceptionally high tides occurred, forcing multitudes of Dovekies to seek refuge. These, driven inland, were found by the hundreds on Fresh Pond, Cambridge. Brewster says "It is probable that the memorable flight which inundated Southern Massachusetts . . . comprised nearly, if not quite all the birds which were living at that time off our coast." The total number seen in this visitation was apparently under a thousand, since the largest figure mentioned was that at Fresh Pond.

The 1932 influx of Dovekies, as recorded by Murphy and Vogt, occurred in November and December and, "apparently unprecedented within the historic period, took place along the coast of North America." Thousands were seen, dead or alive, but the total is impossible to determine from the data given. The cause of the November 7–18 flight was "a boisterous northeast storm, wind maximum 50 mph, with heavy rains and a second southeast storm with winds of the same violence occurring on November 19 and 20." In Florida alone, a statistical estimate of 20,000 dead birds on a 400-mile stretch was made. In the same article it is noted that "It is altogether likely that antecedent and somewhat irregular weather conditions over the North Atlantic had first moved masses of them close to the coast of New England and . . . (also that) our continental shore had for some time been a lee shore."

Far different was the Dovekie flight witnessed in Massachusetts in November, 1950, from Halibut Point, Cape Ann, Essex County. This juts out into the ocean on the northeast tip of the cape, with the extreme point, locally known as the "Rock Pile," some 50 feet high, falling vertically to the water below. From this vantage point Dovekies and other water birds have been observed migrating close to shore on numerous occasions in fair weather and foul. On November 10 and 18, 1948, observers saw an estimated thousand "Little Auks" each day, both times in fair weather.

On November 7, 1950, I witnessed a remarkable migration of Dovekies here; in weather that was sunny and mild with a temperature in the lower sixties, wind 8–12 mph from the west-southwest and southwest. Reaching the shore just before noon, we at once discovered that a heavy migration was passing Cape Ann, and from noon to 1:40 p. m. it was observed from the "Rock Pile." The wide expanse of sea seemed covered with flocks of Dovekies streaming by in groups of from 25 to 60. At times a flock pitched into the water just below, the birds dove once or twice and rose to hurry on south. After counting the individuals in a number of flocks until it was possible to estimate their numbers rather accurately, a Zeiss telescope, using the 24× lens, was trained on a bell buoy and used to count the flocks passing it. For ten minutes these were noted and recorded, the total being 1000 birds. As a relief from this taxing observation the migration in general was then watched for a period, and the other birds passing in small numbers were: Common and Red-throated loons (*Gavia immer* and *G. stellata*); Holboell's Grebes (*Columbus grisegena*); White-winged and Surf scoters (*Melanitta fusca* and *M. perspicillata*); Kittiwakes (*Rissa tridactyla*); together with many Gannets (*Moris bassana*). Whether the migration of Dovekies, whose flocks travelled by as far as the eye or instruments could reach, then increased, or whether with experience, more birds were caught by the telescope in the next count, it is hard to determine, but the second total was *900* birds in *5* minutes! Averaging the two counts a total, incredible to anyone who did not see their passage, of 14,000 Dovekies passed the point during the one hour and forty minutes spent there. Actually this is a conservative estimate; the second count was probably more accurate than the first, and in the far distant haze flocks were seen at intervals and only a few were recorded.

I returned at 3 p. m., after a school class, and found that the migration had slowed down; a 10-minute count totalled only 200 birds. By 3:30, small flocks were still passing, with many single birds hurrying by; by 4 p. m. the migration was almost over. When did it begin? If it was at the maximum only during the middle of the day, the total number passing may be estimated at 24,000; if the number seen then was maintained for a longer period, it may well have been double that figure.

During the heavy storm of November 25, 1950, the late Richard C. Curtis of Manchester, Mass., reported 2000 Dovekies passing Halibut Point in one and a half hours, and large alcids—either Razor-billed Auks (*Alca torda*) or Murres, probably *Uria lomvia*—to the number of 120. On November 26, with clearing weather, the flight coastwise was disappointingly meager; but a Dovekie and two Brünnich's Murres were found across the state, in Berkshire County.

This November 7 flight is puzzling. Does a main migration route from their Arctic breeding grounds bring Dovekies close to this outlying point regularly? Otherwise how account for it on a fair day, with a west-southwest and southwest wind? It has been suggested that the storm of November 4–5 was responsible for driving the birds in from the open ocean (Griscom, Audubon Field Notes, February, 1951: 6). But according to the Salem Coast Guard weather station, this was a minor disturbance; on November 4, the sky was overcast, there was drizzle and fog, with the wind blowing only 5–10 mph from the north until 4 p. m. when it shifted to south and increased to 25 mph. On the following day it was shifting between west and south at 16–22 mph and raining until the weather cleared in the afternoon and the wind steadied in the west at 15–20 mph, except for southerly winds along shore. These reports give no hint of a "lee shore," or of a storm intense enough to account for the Dovekie flight of November 7, 1951.—Dorothy E. Snyder, *The Peabody Museum, Salem, Massachusetts.*

An Unusual Nest of the Common Tern (*Sterna hirundo*).—On June 4, 1951, Arnold Smith of Huntington, Long Island, New York, telephoned me that a pair of Common Terns was nesting on the roof of his small cabin cruiser. This boat was anchored in the middle of Huntington Harbor, a few hundred feet from the yacht club. Smith had attempted single-handed to remove the two eggs from inside a coil of rope on the roof the previous day, but the birds had driven him away. Since the birds were very pugnacious, Smith was unable to use his boat and sought my help in getting rid of them.

Since Common Terns are colonial nesting birds and do not usually appear in Huntington Harbor until August, I questioned Mr. Smith's identification of the birds. To my knowledge the only established colonies on Long Island are situated on the outermost eastern extremity, more than 100 miles from Huntington, or on the southern shore which at its nearest point is at least 30 miles away.

Therefore, it was with considerable skepticism that I got into a rowboat and accompanied Smith to his anchored cruiser to evict the birds. However, when about 50 feet from the boat no doubts remained in my mind. The birds were Common Terns and were defending a nest. The facts were just as Smith reported, except that there were now three eggs on the roof of his boat. Photographs of the nest and birds were taken.

Since I have never read of pairs of this species nesting alone so far from an established colony, I consider the incident worthy of record. It is the first nesting of this species in Huntington Harbor that any of the waterfront men can recall.—GEOFFREY GILL, *24 Overlook Drive, Huntington, Long Island, New York.*

Anting of Blue-winged Warbler (*Vermivora pinus*) at Ramsey, New Jersey.—August 10, 1951, was an extremely humid day with some fog during the early morning. Many warblers came into the honeysuckle vines and the maple tree at the back of our house. Among them were four Blue-winged Warblers that stayed together. I watched them from an upstairs window for some time, then came downstairs to scrutinize them more closely with 8-power binoculars. Soon two flew away.

One of the two remaining started collecting nesting materials. The other followed her around with much interest. Finally the female deposited on a fence post the dried grass she was carrying, flew to a branch of the maple tree about seven feet from the ground; thence about 20 feet to a point near the trunk of the tree, where a line of ants was working; and immediately started anting.

Her actions consisted of a definite pattern repeated in every detail three times, the whole operation lasting less than five minutes. The pattern—she picked up an ant, rubbed it through her outspread wings from the under side, and then to the upper tail coverts. This apparently was the limit of this ant's "usefulness," as she dropped it, picked up another, then stiffened her legs as she took three steps backward, put her tail in a position perpendicular to the ground, and used it to sit on as she rubbed the ant through the tail feathers from the under side two or three times.

During the entire operation the second Blue-winged Warbler circled her at about ten inches. A Red-eyed Towhee also took up a ringside position about a foot away and watched both of them.

A specimen of the ants used was collected and sent to Dr. Weber of Swarthmore, Pennsylvania, and Bagdad, Iraq, for identification. He reported the ants to be *Lasius alienus americanus.*

From records examined, including that of Horace Groskin (Auk, 67: 201–209, 1950), I am unable to find any other records of a wood warbler anting.—ELEANOR E. (MRS. JOHN Y.) DATER, *Ramsey, New Jersey.*

Some Further Comments on "Anting."—On June 8, 1951, at 8:30 a. m. a Catbird (*Dumetella carolinensis*) was observed "anting" in my yard. The action took place in an area about 24 inches in diameter where ants had killed the grass, leaving bare dirt on which were several ant hills. The bird "anted" deliberately, placing or rubbing the ants under the left primaries; there was none of the posturing noted by other observers. The act was repeated three or four times when another Catbird, probably the mate of the first, flew close by. The "anting" bird immediately followed the other into a clump of mock orange (*Philadelphus coronarius*) where they had a nest.

Horace Groskin (Auk, 67 (2): 201–209, 1950) enumerated four possible reasons for "anting:" as a means of disinfection and elimination of ectoparasites; to give tone to the muscles; to wipe off the formic acid before eating the ants to rid the bird of endoparasites; and to place the ants under the wing as a food supply during migration. In the occurrence mentioned, the date would rule out the possibility of application of the migration theory.

Mr. Groskin lists nine species of birds found in the United States which have been observed "anting" with subsequent identification of the ants used. The nine are members of seven families in the order Passeriformes. Of this group the stomach contents of six have included ants. These are Catbird (*Dumetella carolinensis*), Song Sparrow (*Melospiza melodia*), Red-eyed Towhee (*Pipilo erythrophthalmus*), Scarlet Tanager (*Piranga olivacea*), Cowbird (*Molothrus ater*), and Purple Grackle (*Quiscalus q. quiscula*). I have found no mention of ants having been eaten by others, *viz.*, Eastern Robin (*Turdus m. migratorius*), Starling (*Sturnus v. vulgaris*), and Western Crow (*Corvus brachyrhynchos hesperis*).

Since three species "ant" but apparently do not eat ants, it would appear that "anting" is not done preparatory to eating the ants used. The Picidae, which subsist largely upon ants, are not included in the list of "anting" species. The Northern Flicker (*Colaptes auratus luteus*) has frequently been seen feeding on the ants in the colony referred to above, but no "anting" by this species while on the area has been observed. Unless it can be shown that birds which eat ants are less subject to infestation than those which do not eat them, it would seem that ants are eaten for food and not for the elimination of endoparasites.

Specimens of the ants which the Catbird was seen to use were collected. These were identified by Dr. E. V. Enzmann of Still College of Osteopathy and Surgery as *Formica fusca subsericea* (Say). Since this is one of the species that excretes formic acid, some bird lice (Mallophaga) were obtained from trapped English Sparrows and subjected to a spray of formic acid. This was evidently disagreeable to the lice and caused them to flee, but it was not lethal.

Of the theories advanced in explanation of "anting," the one bearing on the elimination of ectoparasites seems the most reasonable.—WOODWARD H. BROWN, *4815 Ingersoll Ave., Des Moines, Iowa.*

A New Name for a Flowerpecker from the Philippines.—We are indebted to Mr. H. G. Deignan for calling to our attention that the name *Dicaeum rubricapilla* which we (Amer. Mus. Novit., No. 1545: 5, 1952) recently applied to a new species of flowerpecker from Mt. Kampalili, Mindanao, Philippine Islands, is preoccupied by the name *Dicaeum rubricapilla* Lesson (Traité d'Ornith., livr. 4: 303, 1830); "l'Inde?"). We propose to correct this error by calling the Philippine species *Dicaeum kampalili*, new name.—CANUTO G. MANUEL, *Philippine National Museum, Manila*, and E. THOMAS GILLIARD, *American Museum of Natural History, New York.*

A Record for *Neodrepanis hypoxantha* of Madagascar.—*Neodrepanis hypoxantha* was described by Salomonsen (Bull. Brit. Orn. Club, 53: 182, 1933) from two specimens, male and female, found in the British Museum (Natural History). These were collected by the Rev. W. Dean Cowan east of Tananarive, Madagascar, in July, 1881. Recently I have had occasion to examine the structural details of *Neodrepanis*, and in the U. S. National Museum collections I have found a male of *N. hypoxantha*, previously identified as *N. coruscans*, secured by the Rev. James Wills in October or November, 1895, marked "E. Imerina." In view of the few specimens known it is of interest to place this on record.

In correspondence accompanying the collection of birds with which the skin under discussion was obtained, the Rev. Wills indicated that he was engaged in mission work, and that most of his specimens were secured through his native teachers whom he had taught to skin birds and mammals. He writes further that "as I am in Imerina, the majority of my spoils are from the upper forest of the eastern side of the island." Mr. James M. Darley, Chief Cartographer of the National Geographic Society, informs me that on one map of Madagascar "Imerina" is marked as a region 15 miles to the south and southeast of Tananarive, while on another the "Plateau de l'Imerina" is shown just to the north of Tananarive. While the location is not wholly certain it appears to have been in the east central part of the island, and in the higher elevations from which the original forests have been almost completely destroyed in the last 40 years. From the rarity of *Neodrepanis hypoxantha* in collections it appears probable that it may have been restricted to these higher forests which few collectors penetrated, while the related *Neodrepanis coruscans* ranged in the lower levels. It is possible that *N. hypoxantha* may have become extinct with the destruction of the forests since it was not encountered during the work of the Mission Zoologique Franco-Anglo-Américaine à Madagascar which covered the island in 1929 and 1930.

The National Museum specimen of *N. hypoxantha* (No. 159,285) is a flat specimen in fair condition, and is a bird of the year that differs somewhat from the adult male described by Salomonsen. In the National Museum specimen the throat, foreneck, upper breast, and under tail-coverts are old gold, and the breast, abdomen, sides, and under wing mustard yellow; the crown and hindneck are olive; sides of the head back of the auricular area, and sides of neck black; the lower hindneck, back, rump, upper tail-coverts, wing-coverts and outer webs of inner secondaries deep, iridescent blue; wings and tail dull black. The large wattle found around and behind the eye in adults is only faintly indicated above the upper eyelid, the rest of the region being feathered.

Measurements are as follows: wing, 47.9; tail, 21.4; culmen from base, 20.9; and tarsus, 13.4 mm. The tip of the bill is very finely acuminate, so slender that it is fragile and could be easily broken. In fact it is bent in the present specimen, while Salomonsen remarked that it was gone in both of the British Museum skins. The outline of the bill and of the attenuate outer primary agree with the sketches in the original description.—ALEXANDER WETMORE, *Smithsonian Institution, Washington 25, D. C.*

Corrections of Names in the Avian Subfamily, Timaliinae.—In consequence of the modern trend toward "lumping" of genera, at least four babblers require changes of names, for reasons to be explained below; and the generally accepted name of a fifth proves to have been the result of an unnecessary renaming. Owing to loss of my library during the war, I have had to request confirmation of my conclusions by Messrs. Jean Delacour and H. G. Deignan, to whom my thanks are hereby expressed.

1. *Argya* Lesson, 1831, is now united with *Turdoides* Cretzschmar, 1827. Under these circumstances, *Crateropus plebejus anomalus* Hartert (Nov. Zool; 28: 116, 1921: Farniso, near Kano) [= *Turdoides plebeja anomala* (Hartert)] must be used in place of *Crateropus plebejus gularis* Reichenow (Orn. Monatsb., 18: 7, 1910: Lamurole, Mba, S. Adamawa) [= *Turdoides plebeja gularis* (Reichenow)], not *Chatarrhaea gularis* Blyth, 1855 [= *Turdoides gularis* (Blyth)].

2. *Trochalopteron* Blyth, 1843, and *Grammatoptila* Reichenbach, 1850, are now united with *Garrulax* Lesson, 1831. Under these circumstances, *Grammatoptila austeni* Oates (Fauna of British India, Birds, 1: 104, 1889: Dafla and Eastern Naga Hills) becomes preoccupied by *Trochalopteron austeni* Godwin-Austen (Journ. Asiat. Soc. Bengal, 39: 105: 1870: Khasi Hills) [= *Garrulax austeni austeni* (Godwin-Austen)]. For *Grammatoptila austeni* Oates, 1889 (now considered a race of *Garrulax striatus*), I propose

Garrulax striatus brahmaputra, new name.

3. *Ianthocincla* Gould, 1835, and *Trochalopteron* Blyth, 1843, are now united with *Garrulax* Lesson, 1831. Accordingly, *Ianthocincla ocellata similis* Rothschild (Nov. Zool., 28: 34, 1921: Shweli-Salwin Divide, Yunnan) becomes preoccupied by *Trochalopteron simile* Hume (Ibis, (3) 1: 408, 1871: Gilgit) [= *Garrulax variegatus similis* (Hume)]. For *Ianthocincla ocellata similis* Rothschild, 1921 (now considered a race of *Garrulax ocellatus*), I propose

Garrulax ocellatus maculipectus, new name.

4. *Fulvetta* David and Oustalet, 1877 (of which *Proparus* Blyth, 1844 [not *Proparus* Hodgson, 1841], is a synonym) is now united with *Alcippe* Blyth, 1844. Under these circumstances, *Fulvetta insperata* Riley (Proc. Biol. Soc. Washington, 43: 123, 1930: Ndamucho, south of Lutien, Yunnan) [= *Alcippe cinereiceps insperata* (Riley)] must be used in place of *Proparus striaticollis yunnanensis* Rothschild (Bull. Brit. Orn. Club, 43: 11, 1922: Mekong-Salwin Divide, Yunnan) [= *Alcippe cinereiceps yunnanensis* (Rothschild); see Greenway, Bull. Mus. Comp. Zool., 74: 136, 1933], not *Alcippe fratercula yunnanensis* Harington, 1913.

5. *Yuhina diademata delacouri* Yen (Sci. Journ. [College of Science, Sun Yat-sen Univ., Canton], 6: 358, 362, 1934) was proposed as a substitute name for *Yuhina diademata obscura* Delacour and Jabouille (L'Oiseau et la Revue Française d'Ornithologie, 11: 403, 1930: Fansipan, Chapa, Tongking), believed preoccupied by *Yuhina occipitalis "obscura"* Rothschild, 1921. Yen's name has been adopted by recent workers in Indo-Chinese ornithology, but since Rothschild's name was, in fact, *Yuhina occipitalis obscurior*, it does not invalidate *Yuhina diademata obscura* Delacour and Jabouille, which must be restored to use.—Masauji Hachisuka, *Atami, Shizuoka-ken, Japan.*

Longevity of Cuban Red-wing (*Agelaius assimilis*) in Captivity.—In August, 1936, I collected live specimens in Cuba for The National Zoological Park, Washington, D. C. There were several Cuban Red-wings among my many crates of birds. In March, 1951, the last Red-wing died in captivity in its cage in the bird house.

This bird spent its entire life in the zoo in a cage by itself. Although it was not banded, there is no question that the life span of this individual was approximately 15 years.—Malcolm Davis, *National Zoological Park, Washington, D. C.*

NOTES AND NEWS

At the Seventieth Stated Meeting recently held in Baton Rouge the following officers were elected for 1952–53: *President*, Josselyn Van Tyne; *Vice-Presidents*, Alden H. Miller and Ludlow Griscom; *Secretary*, Albert Wolfson; *Treasurer*, R. Allyn Moser. *Elective Members of the Council:* Jean Delacour, Harvey I. Fisher, Herbert L. Stoddard.

The Council elected Robert W. Storer, *Editor* of 'The Auk;' Frederick V. Hebard (Chairman), G. Ruhland Rebmann, Jr., and Phillips B. Street, *Investing Trustees*.

The 1952 Brewster Medal was awarded, by action of the Council, to Dr. John T. Zimmer of the American Museum of Natural History for his research on the systematics and distribution of South American birds, especially those of Peru.

The following Members were elected to the class of Fellows:

Emmet Reid Blake, Chicago, Illinois.
Paul Lester Errington, Ames, Iowa.
Elsie Margaret Binger Naumburg, New York, New York.
William Henry Phelps, Sr., Caracas, Venezuela.
Robert Winthrop Storer, Ann Arbor, Michigan.
Albert Wolfson, Evanston, Illinois.

The following persons were elected Corresponding Fellows:

Armando Dugand, Colombia.
Jack William Davies Goodall, Santiago, Chile.
Alfred William Johnson, Santiago, Chile.
Rodulfo Amando Philippi B., Santiago, Chile.

The following Associates were elected to the class of Members:

William J. Baerg, Fayetteville, Arkansas.
Andrew John Berger, Ann Arbor, Michigan.
William Bertram Cartwright, Manitoba, Canada.
Howard L. Cogswell, Berkeley, California.
Joshua Clifton Dickinson, Jr., Gainesville, Florida.
Harold Carsten Hanson, Urbana, Illinois.
Margaret Brooks Hickey, Madison, Wisconsin.
M. Brooke Meanley, Baltimore, Maryland.
Robert James Newman, Baton Rouge, Louisiana.
Raymond Andrew Paynter, Jr., New Haven, Connecticut.
Phillips Borden Street, Philadelphia, Pennsylvania.
George Guion Williams, Houston, Texas.

The number of Associates elected was 566, one of the largest annual numbers in the history of the Union.

Mrs. Herbert E. Carnes and Mrs. Carll Tucker became Patrons of the Union.

The Fellows and Members, meeting together, accepted the invitation of the Los Angeles County Museum to hold the Seventy-first Stated Meeting in Los Angeles in October, 1953. Jean Delacour was appointed Chairman of the Local Committee on Arrangements.

Registration totalled 286, a record for meetings at which there has been a registration fee; included were persons from thirty-three States, Canada, Brazil, Puerto Rico, and Venezuela.

The complete Proceedings of the Seventieth Stated Meeting will be published in the April issue of 'The Auk.'—ALBERT WOLFSON.

The International Commission on Zoological Nomenclature has recently published (Bull. Zool. Nomenclature, Vol. 9, Triple Part 1/3, Oct. 1952. Price, 1 pound, 13 shillings from the International Trust for Zoological Nomenclature, Publications Office, 41, Queen's Gate, London, S. W. 7.) 22 applications submitted to them relating to the names of birds. Several of these applications deal with conserving the names of well-known North American birds, a matter of interest to most members of the A.O.U.

The Commission invites comments on all of the applications published. Comments should be submitted in duplicate and must be received before April 15, 1953. The Secretary requests that the comments be typed on one side of the paper only and that comments on each application be on a separate sheet of paper and bear the Commission's reference number as listed in the Bulletin.

Comments should be addressed to Francis Hemming, Secretary, International Commission on Zoological Nomenclature, 28, Park Village East, Regent's Park, London, N. W. 1, England.

Membership of 1952 committees.—The complete list of members of the Union's Committee on the Nomination of Associates has not hitherto been published. The following served during the past year: I. C. Adams, Jr., Gordon Alexander, James P. Anglin, Mrs. Herbert E. Carnes, Herman F. Chapman, William S. Clarke, Jr., Roland C. Clement, Ben B. Coffey, Jr., J. Fred Denton, John L. Diedrich, Clara Dixon, J. Harold Ennis, Alfred E. Eynon, Rowley Frith, Robert T. Gammell, Herman Goebel, Lawrence I. Grinnell, Gordon W. Gullion, Harvey L. Gunderson, Fred T. Hall, George E. Hudson, Thomas A. Imhof, Henry C. Kyllingstad, Edward B. Lang, Louis Lemieux, Frederick W. Loetscher, George H. Lowery, Jr., Douglas S. Miller, Gale Monson, J. J. Murray, Robert A. Norris, Christopher M. Packard, Thomas L. Quay, Chandler S. Robbins, Oliver K. Scott, Angus H. Shortt, Alexander Sprunt, Jr., W. Austin Squires, Kenneth E. Stager, Louis A. Stimson, Frank G. Watson, William F. Rapp, Jr. (Vice-Chairman), and Aaron M. Bagg (Chairman).

Other additions to committees during the year were as follows:

Committee on Biography: David L. Garrison.
Committe on Endowment: Douglas S. Miller.
Committee on Bird Protection: H. Everest Clements.

Membership of 1953 Committees:

Advisory Committee on Bird Protection: Ira N. Gabrielson (Chairman), Ludlow Griscom, Hoyes Lloyd.

All other committees will be listed in the April issue of 'The Auk.'

This issue of THE AUK has been sent to all persons on the 1952 Membership Roll. To insure receiving the future numbers of Volume 70, promptly remit dues for 1953 to R. Allyn Moser, Treasurer, 90th and Farnam Streets, Omaha 6, Nebraska.

RECENT LITERATURE

The Relation of Metabolism to Climate and Distribution in Three Finches of the Genus *Carpodacus*.—George William Salt. Ecol. Monog., 22, 1952: 121–152. *C. mexicanus* inhabits lowland plains and chaparral; *C. purpureus*, the montane and boreal coniferous forests; and *C. cassinii*, the higher or subalpine forests. Correlations are made between 1) metabolic responses of the three species to temperature and humidity, 2) climatic conditions of their natural habitats, and 3) adjustments in behavior to the different ecological niches occupied. Comprehensive investigations of this sort are highly desirable.

The present paper, however, is not altogether convincing because of weakness in the measurement and interpretation of the metabolism data. Each of the points in the figures presented to indicate rate of oxygen consumption is based on only a single half-hour period on a single bird. Dr. Salt explains in personal correspondence that actually three or four determinations were required before a reliable one was recorded. Determinations were thrown out whenever there was any doubt about them because of activity on the part of the bird, saturation and matting of the bird's feathers at high humidities, slowing down of air-flow because of caking of the chemical absorbents, or other irregularities in performance of the apparatus. Records on the same bird are distributed through the temperature range at both humidities. Altogether 20 *C. mexicanus*, 12 *C. purpureus*, and 8 *C. cassinii* were used in the experiments.

In further explanation, Dr. Salt states that continuous recording over 7 hours on some birds showed a progressive decline in the rate of oxygen consumption without any constant state being reached. The obtaining of similar duplicate and triplicate measurements on the same bird, as is usual procedure in experimental studies of this sort, was not possible. Each record, therefore, is a half-hour section of the rate curve a given distance from its origin. To the reviewer, this does not seem a legitimate procedure and certainly does not represent the bird at equilibrium with its environment.

The rate of air-flow through the experimental chamber is not given, but the rate was the same for all the measurements. The respiratory quotient was also not measured but assumed to be the same in all three species. Incidentally, the standard or basal state is predominantly one of fat metabolism, not protein metabolism as stated.

Actual measurements were made between 38° and about 20° C., yet curves are extrapolated down to 10° C. Curves are "fitted by inspection" after some "obviously widely divergent" points were eliminated. The abrupt upswing of the curves above 30° or 35° C. in figs. 2 and 3 are based principally on two points in each case and are probably not justified. The wide scattering of points at and above 30° C. in fig. 3 may possibly be due to differences in activity on the part of the birds (p. 127). The reviewer doubts that the upper limit of the zone of thermoneutrality was actually determined in any instance.

There is considerable discussion concerning the relative efficiency of water evaporation in the three species at the higher air temperatures, but this speculation is unsupported by experimental data. Although it is true that energy requirements are minimum in the zone of thermoneutrality, evidence now available does not warrant assuming that this zone represents "optimum climatic conditions as related to metabolism" for free-living active birds in their natural environments. Actually the zone represents conditions near the upper limit of temperature tolerance wherein the birds can exist only by curtailment of all excess activity.

All the birds were acclimated during three months to the same climatic conditions, as is desirable for demonstrating genetic differences. However, the amount of acclimation required of the three species was not the same, as the locality of the investigation was marginal in the breeding ranges of *C. mexicanus* and *C. purpureus*, and entirely outside the range of *C. cassinii*. There is likelihood that the responses of the birds and the limits of the thermoneutrality zone, if determined on birds immediately after capture, would have been different and would have more nearly represented their actual adjustments to the different environments in which they naturally occur.

In spite of these various criticisms this paper presents the germ of an interesting and worthwhile concept that should encourage further research along similar lines.—S. CHARLES KENDEIGH.

Zur Ethologie junger Anatiden.—ERIC FABRICIUS. Acta Zoologica Fennica, 68: 1–178, 6 figs., 1 table, 9 photos., 1951.—This paper, in German with an excellent English summary, is concerned primarily with the experimental study of the release of the following-reaction and the associated imprinting phenomena in young ducks. Young eiders (*Somateria mollissima*), Tufted Ducks (*Aythya fuligula*), and Shovellers (*Anas clypeata*) were the subjects of the author's experiments, the results of which are in general agreement with the theories published by Lorenz. Optical and auditory stimuli were found to be effective in releasing the innate following-reaction. Each of the stimuli was shown to be independently effective, although their relative effectiveness varied with the species. When the various stimuli were offered successively (heterogeneous summation), a more pronounced releasing effect was produced.

The effective stimuli responsible for the first release of the following-reaction were found to be simple and generalized. The lack of specificity of this initial release was in sharp contrast to the highly specific nature of the later releases. The later releases could only be elicited by objects of the kind that elicited the first release (imprinting). Hence, the effective stimuli, plus acquired elements, elicit a response which has become specific. Once imprinting has occurred, other objects exhibiting stimuli which could have released the initial following reaction now either have no effect or elicit escape reaction. The probable reason for the development of this irreversible specificity appears to be that after the sensitive period "the internal motivation of the following reaction [which started to diminish after hatching] is so low that the innate sign stimuli alone are not able to raise the level of stimulation to the threshold of response, this only happening if the secondary sign stimuli acquired at the imprinting co-operate."

In addition to the illuminating discussion of the following-reaction and the associated imprinting phenomena, many observations on the behavior of downy ducks are recorded. In large part these observations have no direct relation to the main subject material; some might argue that a separate paper was warranted. The discussion of the reactions of young ducks to the young of other broods promises to shed considerable light on the rafting behavior of young of some species of ducks. Other significant remarks in the paper are those on the inherited habitat preference of the young ducks. "Young tufted ducks and shovellers which were left to themselves were—even when newly hatched—strongly attracted to reeds, whereas young eiders avoided reeds and instead were especially fond of swimming along open rocky shores."

So many interesting aspects of the behavior of young ducks are treated in this paper that one's first reaction is regret that more cannot be said about some of them.

This, of course, is far from being a fault. I hope that the author will publish further observations soon and that others will be stimulated by his example to embark on similar fruitful lines of research.—PHILIP S. HUMPHREY.

The Birds of the Malay Peninsula, Singapore and Penang. A. G. Glenister. Illustrated by Elizabeth M. E. Glenister. (Oxford Univ. Press, London), xiv + 282 pp., 8 col. pls., 8 monochrome pls., 54 line drawings, one map, 1951. $6.00.—This volume provides a handy guide to the birds known to occur in Malaya, Singapore, Penang, and peninsular Thailand, and in an appendix a list of species found near by in Sumatra, Borneo, and Java. The author has attempted to break down the numerically tremendous bird life of this subregion into smaller areas of reference by listing the typical bird-life of towns and gardens, the bird-life of hill stations, and the birds which are of primary interest to the sportsman. He has also characterized each species with notations as to its abundance, status as resident or migrant, etc., and the altitude at which it might be seen. In addition he has made a list of characteristic bird sounds and habits, both very useful, and a chart of the presence or absence of noticeable colors in the different bird families. All these sorts of keys are very welcome to the bird student and should help greatly, with any application, the quest of the average amateur seeking information on a bird just seen.

There is a useful chapter on the different families of birds, and finally a more detailed listing of the actual species and subspecies with notes on the occurrence of these forms and the Malay names. All of this is packed into an octavo volume of five and three quarters by eight and three quarters inches which is a trifle big to get into the pocket, but still a handy and usable size. Appendix A is a useful glossary of Malayan bird names. Appendix B, the list of species found outside Malaya in Sumatra, Borneo, and Java is perhaps too complicated a subject for the amateur. The distribution and taxonomy of many of the species mentioned is still obscure. There are often strong differences of opinion or omissions involved here which make this list rather debatable. Various authorities differ considerably on the status or nomenclature of different species or genera, and it is only necessary to peruse this section of Mr. Glenister's book to see that at present there is a nomenclatoral hodgepodge caused by the different works of Chasen, Delacour, and Gibson-Hill, let alone monographs or other smaller regional papers by other authors. Perhaps this will all be resolved in the future, but in the meantime it is likely to cause the amateur considerable inconvenience and a feeling of uncertainty. Under the circumstances it might almost have been better not to have attempted this listing, which is at best incomplete, *i. e.* the White-winged Wood Duck occurs in Java and Sumatra, and the Javan Gold or Green Finch occurs in Sumatra, to mention only two species. Appendix C is a list of Malayan Hill stations, peaks, and passes, with altitudes.

The plates are prettily colored, restrained, not too bright, and really accurate. They give an excellent impression of the species. The line drawing text-figures are unfortunately not distinguished, although they do give a general impression of the bird or its outstanding feature. A pleasant foreword by the Right Honorable Malcolm MacDonald, himself a distinguished bird-watcher and author, completes this useful and carefully thought-out work on Malayan birds.—S. DILLON RIPLEY.

Know Your Binoculars.—Robert J. and Elsa Reichert. Reprinted from Audubon Magazine, Jan.-Feb. and Mar.-Apr., 1951. The Reicherts' informative paper will be of interest to everyone who plans to purchase binoculars. It is written for the layman and presents clearly the basic information with which all users of field glasses should be acquainted. Members of the A.O.U. may obtain this paper without charge from the Reicherts, Mirakel Repair Co., Mount Vernon, New York.—R.W.S.

The Pocket Guide to British Birds.—R. S. R. Fitter. Illustrated by R. A. Richardson. (Collins, London), xvi + 240 pp., 112 pls., (64 in color). 1952. Price, 21 s.—Collins, a British firm which has recently published many fine books on natural history, has now issued a much-needed "complete identification book" on British birds. To one raised in the Peterson tradition of field identification, this book is quite disappointing. In the main portion of the book, the birds are divided into three groups, Land Birds, Waterside Birds, and Water Birds; within these categories, the arrangement is on the basis of size alone. No actual dimensions are given, however. The size of a bird in the field is one of the most difficult of its attributes to determine. Even the best observers will admit this; and anyone who has asked a novice the size of a bird which he has just seen will realize at once the fallacy of attempting to use size in identifying birds. The advertisement on the jacket claims that this arrangement is preferable to a phylogenetic one; however, there is much to be said for an arrangement according to natural groups. Admittedly, it may be difficult for a beginner to learn the classification; but when he does, he will find that he has learned something useful, a means of finding a bird in other books, and more important, something of biological significance. The members of all genera and families show common structural and behavioral characters which are not only of importance in field identification but also of great value in evolutionary studies; these characters are obscured or even omitted in works based on artificial arrangements. On the other hand, to learn that the Scops Owl is larger than the Swallow which in turn is larger than the Quail is a waste of time, and would indeed be misleading, if weights were to be considered.

In fairness to the author, it must be stated that there is an ingeniously constructed and useful key based on color and pattern, structural features, behavioral features, and habitats. But page references to the descriptions are not given. A migration table is also appended. The descriptions are quite full and contain information on plumage, structure, movement, voice, field marks, habitat, and range and status.

The plates are arranged by color and markings to permit the beginner to see immediately what species of small birds have reddish on the breast or which medium-sized birds are predominantly black. Under this system, the male of a species may be illustrated on one page and the female or young on another. By placing pictures of many birds on each plate, the illustrator has been able to depict the same sex or plumage of a species in several places, a very useful feature. Unfortunately, there is no reference on the plates to the point in the text where the species are discussed, and the user must resort to the index to find this information.

The illustrator has attempted to vary many of the plates by showing the birds in different postures or from different angles. While from an artistic viewpoint this may be desirable, for the person who wants to find out how to tell an Osprey from a Buzzard it is misleading to find a figure of an Osprey with its wings foreshortened to the point where they appear almost buzzard-like. In the plate showing the northern and southern races of the Common Guillemot (Murre), the bird of the latter race is shown from the front so that the back color, which is the most distinctive character of that form, cannot be compared with that of the northern race, another instance in which more careful planning would have made the plate more useful. In general, the land birds are much better portrayed than the sea birds. The Black Guillemot, for instance, is incorrectly depicted with the brown head and postocular crease of the Common Guillemot. The use of the same vernacular name for both groups of birds appears to have led the British not only to overemphasize the similarities between these birds but also to attribute resemblances where none exist.

Finally, there is not always agreement between the text and the illustrations. On page 130 we find that "In flight whole wing [of the Purple Heron] appears nearly uniform . . ." whereas on plate 85, this species is shown with a conspicuous wing pattern in contrast to the Common Heron which is shown with none.

To date this book is the most compact and useful guide to the identification of British birds, and as such it will be useful to those who are encountering this avifauna for the first time.—ROBERT W. STORER.

Our Amazing Birds.—Robert S. Lemmon, illustrated by Don R. Eckelberry. (The American Garden Guild and Doubleday & Co., Garden City, New York), pp. 239, 103 wash drawings. $3.95.

This attractively designed book is rescued by the drawings of Don Eckelberry from the fate of being just one more in an appallingly large series of recent, indifferent volumes on birds. Those interested in the history and evolution of "bird art" will want to possess this latest evidence of the development, in America, of a new and stimulating talent.

Don Eckelberry has something to say, and he says it with remarkable force and clarity. His great assets are originality of approach and a sure, often dramatic, control of lights and darks. No matter what the technical risks, he stubbornly, and usually successfully, resists triteness. Some of the pictures in this book are real contributions to a new type of bird art in America (see especially the American Egrets, pp. 40–41, Common Terns, 72–73, Trumpeter Swans, 88–89, and Bald Eagle, 161). It is no serious criticism to say that Eckelberry's daring has sometimes led him into situations beyond the range of his present technical skill. He has not yet mastered water, that most difficult of subjects. A common pitfall has trapped him in the excellent drawing of the Winter Wren (p. 181), where the wren is perched, not on a twig to its own scale, but in what must, judging from its conformation, be a large tree. Some of his birds are superb (see the Herring Gull, p. 135); many others are not quite authentic (for example the Peregrine Falcon, p. 208, with the head a little too large, and the rather too short-winged Nighthawk, p. 211). He has in places carried the virtue of simplicity to the point of barrenness. Nevertheless, the drawings show the result of fresh, vigorous thought. Here is one more answer to those few who have surprisingly and unjustly proclaimed recent bird artists imitators of Audubon, and who by some esoteric vision claim to detect genius in the work of primitives.

In the text, which, at least by the author's own admission (p. 8) is authentic, Mr. Lemmon explains: ". . . you will find specific facts about nest, eggs, and range [of 102 selected species of North American birds], but above and beyond these I hope you will discover an inkling of what would be called personality if the subject of the sketch were a human being." Although each bird is almost invariably described as "incredible" or "fantastic," the facts set forth appear to me no more "amazing" than any random assortment drawn from nature. Too many of the accounts contain the sort of prejudice that has already done much to harm the conservation cause, as for instance the remarks on the "ruthlessness" of the shrikes. One grows a little tired of the outmoded practice, prevalent in this work, of judging animals by human standards of morality.

It is difficult to tell to what readers the text is addressed. Parts of the accounts are written rather colloquially, but such passages often give way abruptly to quite technical language. Perhaps the most interested readers of this volume, which is ideal neither for children or advanced bird students, will be seekers of the "Believe It or Not" type of sensationalism.—ROBERT M. MENGEL.

The Birds of the Channel Islands.—Roderick Dobson. (Staples Press, London) xvi + 263 pp., 25 pls., 7 maps, endpaper maps, 1952. Price 30 s.—In the course of a century of bird-watching, some two hundred and fifty species have been reported on the Channel Islands. By compiling these records and supplementing them with his own observations, the author makes it possible to determine quickly the status of any bird on each of the Islands. Nomenclature and sequence are according to the *Handbook of British Birds;* the French and English names of each species are also given. Notes on identification, behavior, and breeding are included for most of the birds.

Maps and photographs have been used in lieu of a description of the Islands in the text. They succeed in giving an impression of the country but are inadequate for anyone interested in the ecology and distribution of birds. Such factors as climate and currents are nowhere referred to, and there is little description of the vegetation.

The book indicates the need for more field work in this area, but it is unfortunate that the author has not attempted to analyze the available information. What, for instance, is the relationship of the avifauna of the Channel Islands to that of the adjacent mainland and to that of the British Isles? A major aspect of this problem is that of determining which races actually occur on the Islands. Dobson has assigned to subspecies most of the birds listed, but there are few cases in which an adequate series of specimens has been examined. It would also be interesting to compare the several islands with each other and to see how their bird populations have changed in time. The author briefly discusses some of the factors which may have affected the status of certain species in the past hundred years, but he has refrained from a more thorough analysis.

The book is well indexed and contains a bibliography.—PETER STETTENHEIM.

Förteckning over Sveriges Fåglar.—Sveriges Ornithologiska Förening. (Bokförlaget Svensk. Natur. Stockholm), 103 pp. Price, 7.50 Swedish crowns.—The Swedish Ornithological Society's check-list of Swedish birds, originally prepared by Ulf Bergström, Carl Edelstam, and Gustaf Rudebeck and published in 1948, has been corrected and brought up to date by Edelstam and Kai Curry-Lindahl. The second edition includes 330 full species (an increase of four over the earlier edition), and changes recorded in the literature up to January 1951 have been incorporated.

For the benefit of English-speaking users, there is a Swedish-English glossary of words and expressions commonly used in the list. A map showing the principal regions of Sweden with the abbreviations used for them in the text also increases the utility of the book.—R. W. S.

AMADON, DEAN, AND GLEN WOOLFENDEN. 1952. Notes on the Mathews' collection of Australian birds. Amer. Mus. Novit., No. 1564: 1–16.—Revisions of the various forms of ibises, spoonbills, storks, and herons proposed by Mathews, with some comments on races from other areas.

BAKER, BERNARD, AND EMILIE BAKER. 1952. Loggerhead Shrike [*Lanius ludovicianus*] with malformed bill. Wilson Bull., **64** (3): 161, 1 photo.

BARBOUR, ROGER W. 1952. Migration data from eastern Kentucky. Kentucky Warbler, **28** (2): 23–29.—Spring and fall dates.

BARTLETT, L. M. 1952. On the weight of the Chimney Swift. Bird-Banding, **23** (4): 157–159.—On May 28–29, 1950, 72 *Chaetura pelagica* were weighed at Amherst, Mass.; the weights ranged from 20 to 27 grams, averaging 24.9. The author criticizes Poole (Auk, **55**: 511, 1938) for his broad generalizations based on

one Chimney Swift weighing only 17 grams, which is considerably less than the minimum found by Stewart (Auk, **54**: 324, 1937), namely 21 grams, or that found in the present paper.—M. M. Nice.

BEALS, MARIE V. 1952. New Age Record for a Blue Jay. Bird-Banding, **23** (4): 168.—A *Cyanocitta cristata* of at least 14 years.

BENSON, C. W. 1952. A further note on the spotted forest thrush *Turdus fischeri*. Ostrich, **23** (1): 48.

BERLIOZ, J. 1952. La Poule Sultane d'Allen en Bretagne. L'Oiseau, **22**: 1–5.—First record of *Porphyrula alleni* for France (Brittany coast, December 29, 1951). The only other authentic record for western Europe is off the coast of Yarmouth, England on January 1, 1902.

BERLIOZ, J. 1952. Étude critique des formes de *Momotus momota* (L.). L'Oiseau, **22**: 20–33.—A review of this species; twelve races are recognized.

BLAKE, CHARLES H. 1952. A Population Balance for the Black-capped Chickadee. Bird-Banding, **23** (4): 165–168.—Tables of population changes over a period of five years in banded *Parus atricapillus*.

BOASE, HENRY. 1952. Notes on the Grey Wagtail. Brit. Birds, **45** (9): 317–320.

BOASE, HENRY. 1952. Notes on the courtship display of gulls. Brit. Birds, **45** (9): 320–323.

BOND, JAMES. 1950. The Ruby-crowned Kinglet in Maine and the Maritimes. Bull. Maine Aud. Soc., **6** (1): 9–10.—This kinglet has increased remarkably in numbers.

BOND, JAMES. 1951. Blackpoll Warblers in Maine and the Maritime Provinces. Bull. Maine Aud. Soc., **7** (1): 2–7.—Two distinct and widely separated populations are recognized: a mountain and a lowland or coastal population.

BOND, JAMES. 1951. On vagrants from the south. Bull. Maine Aud. Soc., **7** (4): 72–74.—Notes on the Blue-gray Gnatcatcher, Pine Warbler, Red-eyed Towhee, and Field Sparrow, which have been reported from eastern Maine, but do not nest there or anywhere to the northward or eastward.

BRODKORB, PIERCE. 1951. The number of feathers in some birds. Quart. Journ. Fla. Acad. Sci., 1949, **12** (4): 1–5.

BRYANT, H. C. 1952. Additions to the check-list of birds of Grand Canyon National Park, Arizona. Condor, **54** (5): 320.—Five new species from Havasu Canyon, together with other observations.—W. H. Behle.

CAMPBELL, BRUCE. 1952. Bird watching for beginners. (Penguin Books Inc., Baltimore), 240 pp., 39 figs. Price, $0.65.—The first half of this interesting little book gives general information about the "200 commonest species of British birds." The writing is well done and of a sort that high-school children can understand. This part of the book is a running account of natural groups of birds—not the usual abbreviated species accounts. Part III is concerned with identification, censuses, nest studies, migration, behavior, and photography. In all these the emphasis is on the principles involved and methods of study, rather than on specific information on any species. By informing the beginner, in a readable, interesting way, of some of the things to look for and how to observe and record data, this book makes a definite contribution. It is well worth its cost.—H. I. FISHER.

CHETTLEBURGH, M. R. 1952. Observations on the collection and burial of acorns by Jays in Hainault Forest. Brit. Birds, **45** (10): 359–364.—A small oak grove, nesting territory of two pairs of *Garrulus glandarius*, was the scene of collecting activity of 30 to 40 Jays in October; the birds flew three-quarters of a mile to bury the acorns; it was estimated that 200,000 were thus buried. Apparently the birds remembered the localities of their caches.—M. M. NICE.

CHIAZZARI, W. L. 1952. Some observations on the Natal spotted forest thrush *Turdus fischeri natalicus*. Ostrich, **23** (1): 49–50.

CHIAZZARI, W. L. 1952. Remarks on the range of *Tauraco reichenowi*. Ostrich, **23** (1): 51–52.

CLANCEY, P. A. 1952. Three new races of South African birds. Bonner Zool. Beitr., **3** (1–2): 17–22, 1 photo.—*Turdus libonyanus peripheris* (Pietermaritzburg, Natal), *Anthus lineiventris stygium* (Umgeni River valley, near Pietermaritzburg), and *Poliospiza gularis endemion* (Town Bush, near Pietermaritzburg).

COCKRUM, E. LENDELL. 1952. A check-list and bibliography of hybrid birds in North America north of Mexico. Wilson Bull., **64** (3): 140–159.—A compilation of records of interspecific hybrids.

CONGDON, RUSSELL T. 1952. Nesting of the Hudsonian godwit at Churchill, Manitoba. Condor, **54** (5): 290–291, 2 figs.—A nest with two chicks found on July 15, 1951. Adults and young photographed.—W. H. BEHLE.

CORNWALLIS, R. K. 1952. Patterns of Spring Migration. Brit. Birds, **45** (9): 314–316.

DANA, EDWARD F. 1951. Wood Thrush nesting at Cape Elizabeth. Bull. Maine Aud. Soc., **7** (2): 32–33.—Nest discovered at Cape Elizabeth, Maine on July 10, 1950. Only one bird was seen at a time. No young were ever observed.

DE MORSIER, J. 1952. Un nid double de Moineau domestique (*Passer domesticus* L.) installé sur un arbre en plein vent. L'Oiseau, **22**: 129–130, 4 photos.

DE WAARD, SIMON. 1952. On the Gull-billed Tern at "De Beer" near Hook-of-Holland in 1949. Brit. Birds, **45** (10): 339–341.—In 3 nests of *Gelochelidon nilotica* in 1949 all eggs hatched, but no chicks were fledged. Nine photographs show the nesting birds.

DEXTER, RALPH W. 1952. Extra-parental cooperation in the nesting of Chimney Swifts. Wilson Bull., **64** (3): 133–139, 1 table.—In eight years 22 cases where three Chimney Swifts (*Chaetura pelagica*) and 6 cases where four Swifts nested together were observed. Males seemed to be more numerous than females in these groups, where the work of incubation, etc., was shared.—J. T. TANNER.

DEXTER, RALPH W. 1952. Banding and nesting studies of the Eastern Nighthawk. Bird-Banding, **23** (3): 109–114.—A female *Chordeiles minor* nesting on a roof returned the following year. Incubation lasted 18 days, and fledging 23.

DORST, J., AND CHR. JOUANIN. 1952. Description d'une espèce nouvelle de Francolin d'Afrique orientale. L'Oiseau, **22**: 71–74.—*Francolinus ochropectus*, new species, Day, Tadjoura, French Somali coast.

EMLEN, JOHN T., JR. 1952. Social behavior in nesting cliff swallows. Condor, **54** (4): 177–199, 9 figs.—Four colonies studied near Moran, Wyoming, where adults and advanced nestlings were marked with paints for individual identification in the study of flocking, foraging, loafing, and nesting activities.

ENGEL, H. 1952. Die Verbreitung der Haubenmeise, *Parus cristatus* L. Bonner Zool. Beitr., **3** (1–2): 41–75, 1 fig.

FINNIS, R. G. 1952. Some observations on the movements of birds in southern Italy during the year August 1943–September 1944. Riv. Ital. Ornith., **22** (3): 89–108.—In English with Italian abstract. Dates and localities of records.

FISHER, HARVEY I. 1952. The validity of the fossil crane *Grus nannodes*. Condor, **54** (4): 205–206.—A statistical discussion comparing the type of Pliocene *Grus nannodes* with Recent material of *Grus canadensis* with the conclusion that it is likely that *Grus nannodes* is actually a different and smaller crane.

FITZ PATRICK, JAMES L. 1952. Natural flight and related aeronautics. (Inst. Aernautical Sci., 2 East 64th St., New York), pp. 1–118. Available to nonmem-

bers for $3.50.—This is a bibliography of papers, not annotated, on bird flight; the first reference goes back to 400 B. C., and the last ones are those of 1952. The some 1500 citations are arranged in alphabetical sequence by years. The slight difficulty thus brought about in searching for particular titles or authors is more than compensated for by excellent author and subject indices. There is also an historical index, as well as an index to patents relating to devices simulating the beating wing. All explanatory material is given in English, French, and German.—H. I. Fisher.

Frugis, Sergio. 1952. Osservazioni ornitologiche in Norvegia. Riv. Ital. Ornith., **22** (3): 109–124.

Géroudet, Paul. 1952. Une visite à l'Ile de Sein (Finistère). L'Oiseau, **22:** 58–60.

Ginés, Hno., Ramón Aveledo, Gerardo Yépez, G. Linares, and José Poján. 1951. Contribución al conocimiento de la Región de Baruta El Hatillo. Tercera Parte, Zoología, Aves. Soc. Cienc. Nat. La Salle, **11** (30): 235–323, frontispiece (in color), 14 ills.—List of 152 species.

Goodbody, Ivor M. 1952. The Post-fledging dispersal of juvenile Titmice. Brit. Birds, **45** (8): 279–285.

Green, Roland. 1951. How I draw birds. A practical guide for the bird-watcher. (Adam and Charles Black, London), 96 pp., many ills. $3.00.

Greenhalgh, Clifton M. 1952. Food habits of the California Gull in Utah. Condor, **54** (5): 302–308, 1 fig.—An evaluation of 529 stomachs of *Larus californicus* taken in four years in the Great Salt Lake region. The percentages of the three main categories of stomach contents were gravel 8.61, debris 7.89, and food 83.5. Food items, expressed in per cent, consisted of the following: birds and birds' eggs, 4.49; carrion and garbage, 12.65; cherries, 5.28; Lumbricidae, 2.04; Arthropoda (Miscellaneous), 0.36; Insects (Miscellaneous), 0.24; Coleoptera, 4.70; Diptera, 5.40; Homoptera, 2.59; Odonata, 9.03; and Orthoptera, 53.22.—W. H. Behle.

Gross, Alfred O. 1951. Laughing Gulls nesting at Stratton Island. Bull. Maine Aud. Soc., **7** (3): 52–54.—On May 31, 1951, 29 occupied nests were discovered on this island in southern Maine.

Gross, Alfred O. 1952. The Ivory Gull in Maine. Bull. Maine Aud. Soc., **8** (2): 26–28, 1 pl.—A male Ivory Gull was trapped at Boothbay Harbor, Maine, on January 11, 1952. It was infested with numerous bird lice of two species, *Saemundsonia gonothorax* (Giebel) and *Austromenopon infrequens* (Kell). This is the fourth record for Maine.

Haverschmidt, Fr. 1952. Nesting behavior of the southern house wren in Surinam. Condor, **54** (5): 292–295.—Observations on *Troglodytes musculus* regarding display, nesting and rearing young.

Hayward, C. Lynn. 1952. Alpine biotic communities of the Uinta Mountains, Utah. Ecol. Monog. 22: 93–120.—Breeding birds include only the Mountain Pipit (*Anthus rubescens alticola*), Rock Wren (*Salpinctes obsoletus*), and Black Leucosticte (*Leucosticte atrata*). Neither the White-tailed Ptarmigan (*Lagopus leucurus*) nor the Desert Horned Lark (*Otocoris alpestris leucolaema*), which occur elsewhere in the alpine meadow, are found here.

Hutchinson, G. Evelyn. 1952. Marginalia. Amer. Scientist, **40:** 146–153.—A review and interpretation of recent papers, especially those of A. J. Marshall, on the behavior of bowerbirds.

Hutchinson, G. Evelyn. 1952. Marginalia. Amer. Scientist, **40:** 687–689.—Contains a summary of the discovery by Gustav Kramer and others of the ability of birds to maintain constant direction by means of observation of the sun, despite its movement.

JONES, GLENN. 1952. Hail damage to wildlife in southwest Oklahoma. Wilson Bull., **64** (3): 166–167.—7 species of birds and 3 of mammals were killed by an October hail storm. 60 Swainson's Hawks (*Buteo swainsoni*) and 41 Bobwhite Quail (*Colinus virginianus*) were the largest numbers of one species. The Swainson's Hawks were migrating.—J. T. TANNER.

LABITTE, ANDRÉ. 1952. Comparaison des dates d'apparition et de reproduction de quelques oiseaux dans le département d'Eure-et-Loir. L'Oiseau, **22**: 34–40.—First dates of the arrival and of the laying of the first egg in western France over a period of about 20 years of *Phylloscopus collybita*, *P. trochilus*, *Phoenicurus phoenicurus*, and *P. ochruros*.

LABITTE, ANDRÉ. 1952. Notes sur la chouette hulotte, *Strix aluco sylvatica* Shaw 1869, dans le département d'Eure-et-Loir. L'Oiseau, **22**: 107–112.—Notes on the breeding, eggs, and food of this species. The food brought to the young is apparently rather different from the food of the adult.

LACK, DAVID, AND ELIZABETH LACK. 1952. The Breeding Behaviour of the Swift. British Birds, **45** (6): 186–215.—Very valuable observations for 4 years on 16 to 20 pairs of *Apus apus* nesting in boxes with glass backs. Mutual preening of the pair is described, as well as violent fights with intruders. Nest material is caught in the air and stuck down with saliva. Non-breeding pairs, apparently yearlings, continue to build all summer. Parents share incubation equally. Young leave the nest independently of their parents and apparently start at once on their migration.

LEGENDRE, MARCEL. 1952. Les oiseaux-mouches en captivité. L'Oiseau, **22**: 41–47.—Hummingbirds in captivity.

LONG, RALPH H., JR. 1951. A new nesting record for the Blackpoll Warbler. Bull. Maine Aud. Soc., **7** (1): 7–8, 1 pl.—On June 13, 1950, a nest was found under construction on Little Duck Island, Penobscot Bay, Maine. On July 8 the nest contained four young. This is believed to be the southernmost nesting record for sea level populations of this species.

LONG, RALPH H., JR. 1951. A nesting Barred Owl on Mt. Desert Island. Bull. Maine Aud. Soc., **7** (2): 33–34.—Young left nest during week of May 28, 1950. Food found in nest cavity included: Flying Squirrels, Red Squirrels, White-footed Mice, Moles, and Green Snakes.

LOVELL, HARVEY B. 1950. Observations of nesting activities of the Redstart. Bull. Maine Aud. Soc., **6** (4): 49–50.

LUNK, WILLIAM A. 1952. A hooded merganser from the late Pleistocene of Oklahoma. Condor, **54** (5): 316–317.—Remnants of *Lophodytes cucullatus* taken from deposits laid down in a fresh water basin, the Nye Sink.

LYSAGHT, AV. 1952. Manchots de l'Antarctique en Nouvelle-Guinée. L'Oiseau, **22**: 120–124.—The author shows that the three species of penguin illustrated and described by Sonnerat in 1776 in his "Voyage à la Nouvelle-Guinée" had probably been collected by Commerson some years previously in the Falklands and in the Straits of Magellan.

MACKENZIE, J. M. D. 1952. Fluctuations in the numbers of British tetraonids. Journ. Anim. Ecol. **21**: 128–153.—Bag records of *Lagopus scoticus*, *Tetrao urogallus*, *Lyrurus tetrix*, and *Lagopus mutus*, in central Scotland, dating back to 1834, show population fluctuations of mostly 5 or 6 years, possibly due to changes in food produced by weather.

MAEBE, J., AND H. VAN DER VLOET. 1952. Over Rui, Trek en Biologie der Bergeend, Tadorna tadorna (L.) aan de Beneden-Schelde. Gerfaut, **42** (1–2): 59–83, 3 figs., 5 photos.—Molt follows the usual pattern for surface-feeding ducks.

Drakes molt earlier than ducks, and the molt-migration (July) takes the birds to the molting grounds. By October the Sheld-duck is on the winter grounds. The non-breeding population is made up for the most part of adult pairs in small flocks, up to 12 birds, on the feeding grounds. Spring migration is chiefly in February and March. There is much information on the breeding behavior. French and English summaries.

MARIEN, DANIEL. 1952. The systematics of *Aegithina nigrolutea* and *Aegithina tiphia* (Aves, Irenidae). Amer. Mus. Novit., No. 1589: 1–17.—Subspeciation, molts, plumages in these interesting leafbirds (or bulbuls, as they were formerly considered to be) in which a transition from green-backed to black-backed plumage in the male is sometimes an age phenomenon, sometimes a geographical one.

MARSHALL, DAVID B., AND J. R. ALCORN. 1952. Additional Nevada bird records. Condor, **54** (5): 320–321.—Annotated list of 9 species.

MASON, EDWIN A., AND MARY S. SCHAUB. 1952. Final report of the Connecticut Valley Evening Grosbeak survey for the winters of 1948–49 and 1949–50. Bird-Banding, **23** (4): 139–144.

MAYFIELD, HAROLD. 1952. Nesting-height preference of the Eastern Kingbird [*Tyrannus tyrannus*]. Wilson Bull., **64** (3): 160.

MAYR, ERNST, AND E. THOMAS GILLIARD. 1951. New species and subspecies of birds from the highlands of New Guinea. Amer. Mus. Novit., No. 1524: 1–15.—*Melidectes princeps* from 11,800 feet, Mt. Wilhelm, Bismark Mts., new species. *Synoicus ypsilophorus lamonti* from 8000 feet, Mt. Hagen; *Rallus pectoralis captus* from 7800 feet, Tomba, Mt. Hagen; *Rallus philippensis wahgiensis* from 5600 feet, Nondugl, Wahgi Valley; *Rallus philippensis randi* from 3390 feet, northeast Mt. Wilhelmina; *Psittacella modesta hallstromi* from 6000 feet, Yandara, Mt. Wilhelm; *Psittacella picta excelsa* from 7500 feet, Mt. Orata, Kubor Mts.; *Turdus poliocephalus carbonarius* from 11,500 feet, Mt. Wilhelm; *Saxicola caprata wahgiensis* from 1250 feet, Mafulu, Papua; *Megalurus timoriensis montanus* from 12,000 feet, Mt. Hagen; *Megalurus timoriensis wahgiensis* from Tomba; *Epimachus meyeri megarhynchus* from 6000–7000 feet, Gebroeders Mts., Weyland Range; *Epimachus meyeri bloodi* from 8300 feet, Mt. Hagen; *Paradisea rudolphi margaritae* from 5800 feet, Kimil R., northwest Nondugl; *Pteridophora alberti hallstromi* from 8200 feet, above Tomba; *Zosterops novaeguineae wahgiensis* from 5200 feet, Nondugl; and *Zosterops novaeguineae shaw-mayeri* from 6000 feet, Yandara, new subspecies.

MAYR, ERNST, AND E. THOMAS GILLIARD. 1952. The Ribbon-tailed Bird of Paradise (*Astrapia mayeri*) and its allies. Amer. Mus. Novit., No. 1551: 1–13.—Plumage descriptions and ecological notes on *A. mayeri*, based on Gilliard's field work, with discussion of relationships and hybridization in morphologically very dissimilar forms in this genus.

MENDALL, HOWARD L. 1952. Maine's new citizen—the Ring-necked Duck. Bull. Maine Aud. Soc., **8** (2): 22–25.—A spectacular increase in numbers has occurred the last few years. It now breeds in at least 13 of Maine's 16 counties.

MILLER, ALDEN H. 1952. The generic name of the white-bellied wren of Mexico. Condor, **54** (5): 322.—The name *Nannorchilus leucogaster* should be changed to *Uropsila leucogastra* (Gould).

MILLER, LOYE. 1952. The avifauna of the Barstow Miocene of California. Condor, **54** (5): 296–301, 2 figs.—Report on a new collection of 19 specimens of fossil birds. *Cyrtonyx tedfordi*, a member of the Galliformes, is newly described. Nine species are represented, three of which are "land birds." Seasonal rainfall greater than that of today is indicated.—W. H. BEHLE.

MILON, PH. 1952. Notes sur le genre *Coua*. L'Oiseau, **22**: 75–90, 1 col. pl., 3 figs.—A revision of this genus which is restricted to Madagascar. Ten species, eight of which are monotypic, are recognized; for the other two species, *Coua cristata* and *Coua ruficeps*, four races are recognized for the former which are well illustrated in the colored plate, and two races are recognized for *C. ruficeps*. A very brief description of the biotic regions of Madagascar is included, notes and observations on the reproduction of two races of *C. cristata* and one race of *C. ruficeps*.

MORAN, P. A. P. 1952. The statistical analysis of game-bird records. Journ. Anim. Ecol. **21**: 154–158.—Yearly bag records, dating back to 1834, are given for four tetraonids.

MURPHY, ROBERT CUSHMAN, AND JESSIE M. PENNOYER. 1952. Larger Petrels of the Genus *Pterodroma*. Amer. Mus. Novit., No. 1580: 1–43.—Important taxonomic and natural history studies on about a dozen species of this genus. The conclusions were based, in many cases, upon very large and complete collections made by the Whitney South Seas Expedition.

MURPHY, ROBERT CUSHMAN. 1952. The Manx Shearwater, *Puffinus puffinus*, as a species of world-wide distribution. Amer. Mus. Novit., No. 1586: 1–21.—The author brings together into one species eight forms, *puffinus, mauretanicus, yelkouan, gavia, huttoni, newelli, auricularis*, and *opisthomelas*, on the basis of similarities in size, color, proportions, and habits, plus allopatric distribution. Some of these races are black-backed, some brown-backed. The forms representing the two types alternate geographically, suggesting that the two groups may have spread around the globe in opposite directions. Two west coast forms carried on the A.O.U. "Check-list" (4th ed.) as distinct species, *opisthomelas* and *auricularis*, represent the two types of coloration, as do the European *puffinus* and the Mediterranean *yelkouan*. The latter two have been regarded as races of the same species for many years.—D. AMADON.

NEFF, JOHNSON A., AND BROOKE MEANLEY. 1952. Experiences in Banding Blackbirds in Eastern Arkansas. Bird-Banding, **23** (4): 154–157.—Winter roosts of Grackles (*Quiscalus quiscula*), Cowbirds (*Molothrus ater*), and Redwings (*Agelaius phoeniceus*) in the Arkansas rice-fields may consist of 5,000,000 to 20,000,000 birds. On dark nights two men with head-lamps can band 300 birds in 90 minutes.

NELSON, GID E., JR. 1952. The birds of Welaka [Florida]. Quart. Journ. Fla. Acad. Sci., **15** (1): 22–39, 1 table.—Relationships between avifauna and major plant associations.

NICOULLAUD, J. G. 1952. La Perruche calopsitte *Nymphicus hollandicus* (Kerr) en captivité. L'Oiseau, **22**: 125–218.

PACKARD, CHRISTOPHER M. 1951. Maine Evening Grosbeak survey 1950–1951. Bull. Maine Aud. Soc., **7** (2): 22–27.—Reports of Evening Grosbeaks in Maine during the 1950–51 winter.

PACKARD, CHRISTOPHER M. 1951. Christmas Bird Counts in Maine. Bull. Maine Aud. Soc., **7** (4): 62–70, 5 tables.—An analysis of 100 Christmas counts made from 1904 through 1949.

PACKARD, CHRISTOPHER M. 1952. Evening Grosbeak flight, 1951–1952. Bull. Maine Aud. Soc., **8** (1): 4–6.—Notes on the early fall incursion into Maine. Also notes on 1951 summer records in Maine and New Brunswick.

PARKES, KENNETH C. 1952. Post-juvenal wing molt in the Bobolink. Wilson Bull., **64** (3): 161–162.—An abnormal molt observed in two male *Dolichonyx oryzivorus*.

PARKES, KENNETH C. 1952. Geographic variation in the horned grebe. Condor, **54** (5): 314–315.—Two subspecies are recognized, a Palaearctic race, *Colymbus auritus auritus* Linnaeus, type locality, Sweden, and a Nearctic race, *Colymbus auritus cornutus* Gmelin, type locality, Hudson Bay.—W. H. BEHLE.

PARKS, G. HAPGOOD. 1952. More Evening Grosbeak Notes from Hartford, Connecticut. Bird-Banding, **23** (4): 144–154.—Five per cent of the 2,866 *Hesperiphona vespertina* banded in the last ten years at this station have been recovered.

PETTITT. R. G. 1952. Comparative aggressiveness of the first-year and adult Black-headed Gull. Brit. Birds, **45** (9): 333–334.—First-year *Larus ridibundus* were much more aggressive than the adults, the peak of excitability occurring "in the spring corresponding to the breeding season in the adults."

PINCHON, P. R., AND MARCEL BON SAINT-COME. 1952. Note complémentaire sur l'avifaune des Antilles françaises. L'Oiseau, **22**: 113–119.—Additional species, notes on habits and banding returns.

PYMAN, G. A., AND C. B. WAINRIGHT. 1952. The breeding of the Gull-billed Tern in Essex. Brit. Birds, **45** (10): 337–339.—The first breeding record of *Gelochelidon nilotica* in Britain. A pair nested on an island in the Abberton Reservoir in 1949 and 1950; a nestling was ringed July 4, 1950. Since then the island has been submerged, and no more Gull-billed Terns have been seen in Essex.—M. M. NICE.

RANGER, G. 1952. Life of the crowned hornbill (Part V). Ostrich, **23** (1): 26–36.

ROBERTSON, A. W. P., AND S. C. PORTER. 1952. Long-tailed Tits' unorthodox nesting arrangements. British Birds, **45** (7): 257–258.—Two male and one female *Aegithalos caudatus* were in attendance at one nest, and all three were feeding the 10 young in complete harmony.

ROCHON-DUVIGNEAUD, A. 1952. Les armes des rapaces. L'Oiseau, **22**: 91–106, 9 figs.—A discussion of the claws of the raptores with illustrations and measurements of some species of raptores.

ROUGEOT, P. C. 1952. Observations ornithologiques dans l'Ocean Atlantique. L'Oiseau, **22**: 14–19.—Birds seen from August 17 to September 5, 1951, on a trip from Bordeaux to Senegal.

RYDER, RONALD A. 1952. Bird notes from southern Colorado. Condor, **54** (5): 317–318.—Annotated list of 9 kinds seen in San Luis Valley.—W. H. BEHLE.

SKEAD, C. J. 1952. Cuckoo studies on a South African farm (Part II). Ostrich, **23** (1): 2–15.

SPAEPEN, J. 1952. Over de Trek van de Kleine Gele Kwikstaart (*Motacilla flava* L.). Gerfaut, **42** (1–2): 18–27.—French summary.

SPAEPEN, J., AND P. DACHY. 1952. II. Expériences préliminaires effectuées sur des Martinets noirs, *Apus apus* (L.). Gerfaut, **42** (1–2): 54–59, 2 tables.—Inconclusive experiments on speed of return to nesting site after having been transported to London from Belgium. Dutch and English summaries.

SPAEPEN, J., AND H. FRAGNIÈRE. 1952. Le Problème de l'Orientation chez les Oiseaux Migrateurs. I. Expériences préliminaires effectuées sur des Martinets alpins, *Apus melba* (L.). Gerfaut, **42** (1–2): 49–54.—Inconclusive experiments as to use of visual memory or some special sense in the homing of birds. Dutch and English summaries.

STEINBACHER, JOACHIM. 1952. Jahreszeitliche Veränderungen am Schnabel des Haussperlings (*Passer domesticus* L.). Bonner Zool. Beitr., **3** (1–2): 23–30, 2 figs.

STEWART, PAUL A. 1952. Winter mortality of Barn Owls [*Tyto alba*] in central Ohio. Wilson Bull., **64** (3): 164–166.

STORER, ROBERT W. 1952. Variation in the resident sharp-shinned hawks of Mexico. Condor, **54** (5): 283–289, 2 figs.—The population from Guerrero is

described as new (*Accipiter striatus madrensis*); its type locality is Cuapongo.—W. H. Behle.

Taber, Wendell. 1950. The Ravens and hawks of Katahdin and their behavior. Bull. Maine Aud. Soc., **6** (1): 3–8.

Taber, Wendell. 1950. Northern Clapper Rail at Waldoboro, Maine. Bull. Maine Aud. Soc., **6** (2): 29.—A Clapper Rail was brought in by a cat on December 13, 1949. There were two storms along the coast in early December.

Taber, Wendell. 1950. Pelagic Birds. Bull. Maine Aud. Soc., **6** (4): 47–48.—Cory's and Greater shearwaters, Wilson's Petrels, and Northern Phalaropes near the Isles of Shoals.

Taber, Wendell. 1951. Nesting of the American Three-toed Woodpecker. Bull. Maine Aud. Soc., **7** (2): 29–32.

Taylor, J. Sneyd. 1952. The Ethiopian snipe *Capella nigripennis* at Fort Beaufort, C. P. Ostrich, **23** (1): 37–39.

Thomson, A. Landsborough, and E. P. Leach. 1952. Report on Bird-Ringing for 1951. Brit. Birds, **45** (8): 265–277; (10): 341–357.—85,743 birds were ringed during the year, 49,354 having been trapped, while the rest were nestlings. Most of the report is taken up with a selected list of recoveries. A Barn Swallow, *Hirundo rustica*, reached the age of 16 years (p. 275). A Manx Shearwater, *Puffinus puffinus*, ringed on Skokholm, was taken at Rio de Janeiro (p. 346), while a Kittiwake, *Rissa tridactyla*, ringed at Lundy, was taken in Newfoundland (p. 352).—M. M. Nice.

Tordoff, Harrison B. 1952. Notes on plumages, molts, and age variation of the red crossbill. Condor, **54** (4): 200–203, 1 fig.—Four subspecies were represented in collections from the 1950–51 winter invasion in northeastern Kansas. Age variation in size is of sufficient magnitude to make necessary the determination of age of specimens in samples used for taxonomic purposes. Means of distinguishing first winter birds from adults are discussed.—W. H. Behle.

Udvardy, Miklos D. F. 1947. Methods of bird sociological survey, on the basis of some Tihany communities investigated. Archiva Biologica Hungarica, Series II, **17**: 61–89.—Breeding bird densities varied from 164 pairs in scrubby pasture to 1622 pairs per 100 acres in closed forest. The density of birds in closed forest is based on censuses of 5-acre plots. There is a discussion of census techniques.

Van Beneden, A. 1952. Nouvelles données sur la Dispersion du Grimpereau Macrodactyle (*Certhia familiaris macrodactyla* Brehm) en Belgique. Gerfaut, **42** (1–2): 1–18, 1 fig.—Dutch summary.

Vaurie, Charles. 1952. A review of the bird Genus *Rhinomyias* (Muscicapini). Amer. Mus. Novit., No. 1570: 1–36.—A painstaking taxonomic review of this hitherto imperfectly understood genus, the members of which range from China to the East Indies and Philippines. There are notes on habits and ecology, and the proportions of bill and feet are analyzed to show that the forms of the genus run the gamut from "flycatcher" to "thrush" in superficial aspect. *Rhinomyias colonus pelingensis* from Peling Island, Banggai Gp., Molucca Sea, is described as a new subspecies.

Verheyen, R. 1952. Nos Hirondelles (*Riparia riparia, Delichon urbica, Hirundo rustica*) dans leurs Quartiers d'Hiver. Gerfaut, **42** (1–2): 92–124.—Discussion of migration and wintering of three species of swallows. Extensive bibliography. Dutch summary.

Walkinshaw, Lawrence H. 1952. Chipping Sparrow notes. Bird-Banding, **23** (3): 101–108.—One female *Spizella passerina* nested for five summers in the author's yard in southern Michigan. 277 eggs in 58 nests, 185 hatched (66.8%), and 170

young were fledged (61.4%). A nest was watched for nearly 20 hours on 5 days during incubation; the female averaged 20.5 minutes on the nest and 9 off, averaging 67.5% of the time on the nest. In the poorly insulated nest of this species incubation lasted 11.5 to 14 days, averaging 12.3, in 5 nests when the mean temperature averaged 48.7° to 65.9° F., the low temperatures reaching 30° to 46°; it lasted 11 days in 4 nests when the mean temperature averaged 66.2° to 76.0°, and the low temperatures reached 46° to 53°.—M. M. NICE.

WARNER, DWAIN W. 1952. The Green Kingfisher. Wilson Bull., **64** (3): 131–132, 1 colored plate.—A brief account of the habitat and habits of *Chloroceryle americana;* color plate by George M. Sutton.

WEBSTER, J. DAN, AND ROBERT T. ORR. 1952. Notes on Mexican birds from the states of Durango and Zacatecas. Condor, **54** (5): 309–313.—Annotated list of 33 forms.

WHITE, C. M. N. 1952. Systematic notes on African birds. Ostrich, **23** (1): 43.

WOLFF, TORBEN. 1950. Birds collected by the Atlantide-Expedition to West Africa 1945–46. Atlantide Report, No. 1: 131–149.—The University of Copenhagen's Atlantide Expedition to West Africa was primarily concerned with marine zoology, but some 100 bird skins of 58 forms were collected at various stops made in Senegal, Gambia, Liberia, Nigeria, British Cameroon, and the Belgian Congo. Among them are a number of records of interest. Thus, two birds, *Stercorarius pomarinus* and *Budytes flavus thunbergi*, are additions to the known avifauna of Liberia, while a young *Clamator jacobinus*, too young to have travelled far, is the first indication of this species having bred in southern Nigeria.

WOLFSON, ALBERT. 1952. The cloacal protuberance—a means for determining breeding condition in live male passerines. Bird-Banding, **23** (4): 159–165.

WYNNE-EDWARDS, V. C. 1952. The centenary of William Macgillivray. Scot. Nat., **64** (2): 65–69.

WYNNE-EDWARDS, V. C. 1952. Geographical variation in the bill of the Fulmar (*Fulmarus glacialis*). Scot. Nat., **64** (2): 84–101, 6 figs., 1 table.—Bill structure is a result of adaptations for feeding and epigamic display. A cline of bill-length is shown (shortest in Canada and longest in Europe). Three size-groups are recognized. Body weight may be correlated with bill length.

YEATES, GEORGE K. 1952. Photographies d'oiseaux. L'Oiseau, **22**: 6–13.—Five excellent photos and remarks on photographic methods.

YOUNG, R. T. 1952. Status of the California Gull colony at Mono Lake, California. Condor, **54** (4): 206–207.—Location and size of colony, food, and parasites are discussed. A tapeworm is obtained from the brine shrimp.

ZIMMER, JOHN T., AND WILLIAM H. PHELPS. 1952. New birds from Venezuela. Amer. Mus. Novit., No. 1544: 1–7.—*Chaetura spinicauda latirostris* from Jobure, Rio Jobure, Territorio Delta Amacuro; *Chlorostilbon mellisuga duidae* from 1400 meters, Mt. Duida; and *Elaenia dayi auyantepui* from 2200 meters, Mt. Auyantepui, new subspecies.

OBITUARIES

EARLE AMOS BROOKS, an Honorary Life Associate, elected in 1892, died at Newton, Massachusetts, on April 4, 1952. He was born on April 20, 1871, the son of Adolphus and Josephine (Phillips) Brooks, at French Creek, West Virginia. In this small community of New England families which had settled there a generation before the Civil War, he showed from the start an eagerness for learning and an interest in nature. These qualities were shared by three brothers in his family, one of whom became State Entomologist and another, State Botanist; these qualities were perhaps inherited from a doctor grandfather (partly self-taught) who studied plants for medicinal uses. E. A. Brooks himself became State Ornithologist and the authority on West Virginia's birds.

His vocation was the ministry and his primary work, the teaching of young people. He taught natural sciences at camps and schools under church auspices in several states and later at Boston University. He organized the first boy scout troop in West Virginia, and other troops in communities to which the church subsequently called him. A born teacher, he found opportunity through many agencies to inspire boys and girls with his love of nature and profound interest in it.

His scientific notes in 'The Auk' (1908–1938) show close and thoughtful observation. He also published longer papers: Game Birds of West Virginia (1916), Food of West Virginia Birds (1916), Handbook of the Outdoors (1925), List of the Birds of West Virginia (W. Va. Encyclopedia, 1929), and Bibliography of West Virginia Ornithology (1938).

Called to a pastorate near Boston, he was elected in 1919 to the Nuttall Ornithological Club and became one of its most faithful members.

He is survived by a wife, Ora M., and two children, Frances Eleanor and Chandler McC. Brooks.

It is a fitting memorial that the new science building at West Virginia University is named for Earl Brooks and his brothers.—DAVID L. GARRISON.

JOHN LINDSAY CLARK, elected an Associate of the American Ornithologists' Union in 1950, died in New York City on December 12, 1951. He was born at Steubenville, Ohio, April 25, 1894. After attending Washington and Jefferson University and the University of Wisconsin, he entered the investment field and at one time served as President of the Association of Stock Exchange Firms. Interest in birds was a lifelong avocation.—A. W. SCHORGER.

MARIAN WHITE LITTLE, elected an Associate of the American Ornithologists' Union in 1936, died at Guilford, Connecticut, May 29, 1952. She was born at Newburyport, Massachusetts, August 30, 1874. Miss Little was a special student at Swarthmore College from 1893 to 1896. She was a patron of the Florida Audubon Society, a life member of the Delaware County (Pa.) Institute of Science, a life member of the Delaware County Park Association, and a charter member of the Lantern and Lens Guild of Women Photographers of Philadelphia. Her ornithological activity does not appear to have extended beyond a general interest in birds.—A. W. SCHORGER.

ALICE MAY MACQUARRIE, elected an Associate of the American Ornithologists' Union in 1949, died at Pasadena, California, January 23, 1951. She was born at Southboro, Massachusetts, December 16, 1878, of Scotch parents who came to the latter state from Nova Scotia. For twenty years she was companion to Mrs. Y. S. Jenkins. She became a member of the Pasadena Audubon Society and the national

organization in 1905. A half-century of interest in birds permitted her to become thoroughly familiar with the local species. Interment took place on a beautiful wooded knoll at her old home at Southboro.—A. W. SCHORGER.

ANGIE KUMLIEN (MRS. HERBERT) MAIN, elected an Associate of the American Ornithologists' Union in 1948, died at Fort Atkinson, Wisconsin, August 30, 1952. She was born in the town of Sumner, Jefferson County, Wisconsin, February 20, 1883. Thure Kumlien, the noted Swedish naturalist, who settled at Lake Koshkonong, Wisconsin, in 1843, was her grandfather; and from him she inherited an early and lasting interest in birds. Trained at Whitewater Normal School, she taught in the public schools for several years, and married Herbert Main on March 31, 1908. She was a member of the Wisconsin Academy of Sciences, Arts and Letters, and the Wisconsin Society for Ornithology. Her principal publications were 'Bird Companions' (1925), and 'Thure Kumlien, Koshkonong Naturalist' (1943–44). Shorter papers appeared in the Wisconsin Arbor and Bird Day Annual, Transactions of the Wisconsin Academy, Passenger Pigeon, Jefferson County Union, and Janesville Gazette. Mrs. Main had broad social interests and was active in many organizations in her community. She served as a curator of the State Historical Society of Wisconsin for nearly 25 years. Surviving are her husband and three daughters.—A. W. SCHORGER.

EUGENE EDMUND MURPHEY, elected an Associate of the American Ornithologists' Union in 1934 and a Member in 1940, died at his home in Augusta, Georgia, April 13, 1952, at the age of 76. He was born November 1, 1875, at Augusta, the only child of Edmund Turner Murphey and Sarrah Dobey Murphey, both natives of Richmond County, Georgia. He chose medicine as a profession and graduated at the Medical School of the University of Georgia in 1898, following this by a graduate course at Johns Hopkins University, Baltimore. Taking his talents and training home to Augusta, he lived there his entire life where he well earned the title "The Beloved Physician of Augusta."

Commissioned as a Major in the Medical Reserve Corps, he served through World War I. Though medicine was his profession, Dr. Murphey was an enthusiastic and capable ornithologist. He collected assiduously, maintained a widely diverse collection, and contributed to ornithological journals. He prepared the account of the Red-cockaded Woodpecker for Bent's 'Life Histories of North American Birds,' and his comprehensive knowledge of Georgia birds was frequently quoted in other species accounts of that monumental work.

Equally permanent are his notes, published in book form. Forty-seven years of field work are embodied in 'Observations on the Birdlife of the Middle Savannah Valley' (1937). He prepared the 'Historical Narrative' section for 'Birds of Georgia' by Messrs. Greene, Stoddard, *et al.* (1945). He was an accomplished poet, and birds appealed to his creative spirit to the extent that he produced in rhyme some of his most superb writings. A collection of them was published in 1939 under the title of 'Wings at Dusk.'

Often in attendance at A. O. U. meetings, his hotel room was a veritable mecca for congenial spirits. No host of that somewhat mysterious group of individuals known as the Appleton Club ever ascended to such heights of hospitality as he.

The last years of his life were marred by illness, but never did his interest fail. Even when unable to carry on his usual brilliant conversation, he was ready and willing to listen. A great figure has passed from the scene of medicine and ornithology, but he has left behind him a lasting monument in the hearts of all who were privileged to call him friend.—ALEXANDER SPRUNT, JR.

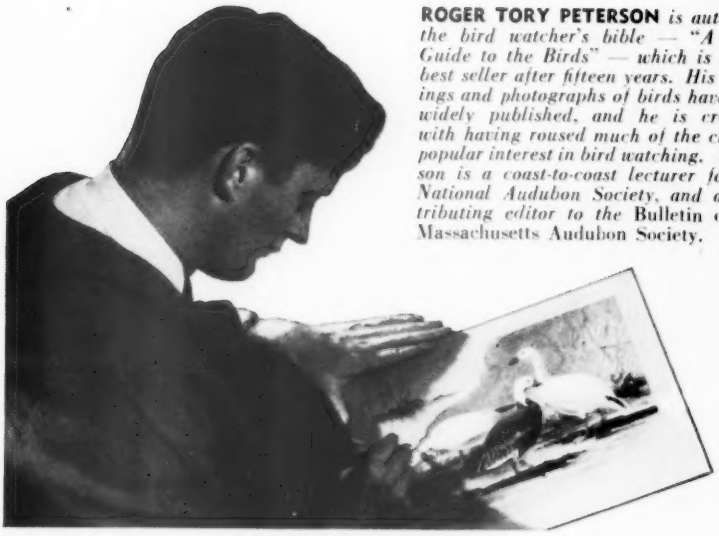
HENRI DES RIVIÈRES, elected an Associate of the American Ornithologists' Union in 1941, died in Quebec on March 25, 1948, at the age of 65. He was born at Notre-Dame de Stanbridge, Province of Quebec, on July 23, 1883. Following a classical course at Quebec Seminary, he joined the staff of the Bank of Montreal. At the time of his retirement, two years before his death, he was general manager of the National Canadian Bank. During his lifetime, he was one of the leading business authorities of the city of Quebec and became the financial adviser of the city council. He was a member of the Garrison Club, Quebec Skeet Club, and a life member of the Quebec Zoological Society.

In 1908, he founded with five of his friends, the Cape Tourmente Game Club of which he was president. During a period of 40 years he never ceased providing full legal protection to the great number of ducks and geese that used the area. When the Club was formed, only 4,000 Greater Snow Geese visited Cape Tourmente and the flock was dwindling rapidly. He had the immense satisfaction of seeing the number of these geese increase to 30,000. Had he lived somewhat longer, he would have seen 50,000. Though an ardent sportsman, he was ever mindful of the conservation of wildfowl and of non-game birds as well.—CHARLES FRÉMONT.

SAMUEL ROBERT SAVAGE, elected an Associate of the American Ornithologists' Union in 1947, died at Overton, Texas, January 31, 1952. He was born at Lisburn, North Ireland, October 18, 1876. His education was received in the schools of Lisburn and Belfast. At the time of his death he had retired as an export trade and travel agent. When a young man he made jointly with John Cotney a collection of birds' eggs that is now in the Belfast Museum. He was a member of the Belfast Naturalist's Field Club and the Cooper Ornithological Club. His interest in birds, following his arrival in this country, does not appear to have resulted in any publications.—A. W. SCHORGER.

MILDRED (MRS. LAWRENCE P.) TALLEY, elected an Associate of the American Ornithologists' Union in 1949, died in Holly Oak, Brandywine Hundred, New Castle County, Delaware, on July 29, 1951. She was born at this place on February 19, 1893. Mrs. Talley taught nature courses in the No. 13 School, Wilmington, Delaware, where she was associated with Miss Violet L. Findlay. Although she never published any papers on birds, she had a life-long interest in their migration, nesting, and other habits. Migration data were accumulated in her locality over a period of twenty-five years.—A. W. SCHORGER.

JAMES DAVIS WHITAKER, elected an Associate of the American Ornithologists' Union in 1924, died at Wellesley, Massachusetts, January 28, 1952. He was born at Lowell, Massachusetts, February 16, 1868. The cotton business occupied his attention for over 50 years, and he was recognized as an outstanding authority in his field. During his long interest in ornithology he formed a considerable collection of New England birds and their eggs, and learned taxidermy to mount his specimens. His interest centered on shorebirds in the last years of his life. Like many students, he failed to publish any of his observations.—A. W. SCHORGER.



ROGER TORY PETERSON *is author of the bird watcher's bible — "A Field Guide to the Birds" — which is still a best seller after fifteen years. His paintings and photographs of birds have been widely published, and he is credited with having roused much of the current popular interest in bird watching. Peterson is a coast-to-coast lecturer for the National Audubon Society, and a contributing editor to the* Bulletin of the Massachusetts Audubon Society.

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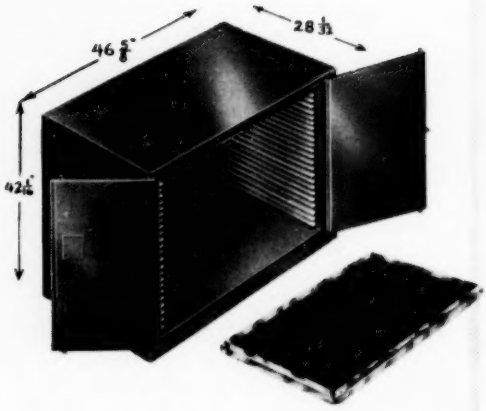

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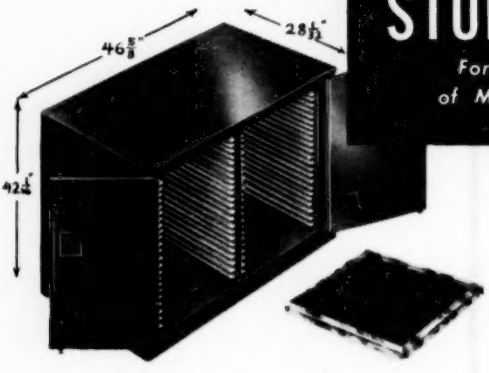

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